THE

ELECTRICAL REVIEW.

VOL. LVII. AUGUST 4, 1905. No. 1,445.

ELECTRICAL REVIEW.

Vol. LVII.] CONTENTS: August 4, 1905. [No. 1,445.

	Page
The L. & Y. Disaster	165
Johnson-Lundell Regenerative System of Electric Traction (*illus.*)	168
The Continental Electrical Engineering Industry	171
Leicester Tramways: Cost of Construction	172
The Treatment of Electrolytic Slimes	172
Correspondence	173
Legal	175
The Telephone Committee's Report	175
Business Notes	176
City Notes	189
Stocks and Shares	192
Share List of Electrical Companies	193
Electric Tramway and Railway Traffic Returns	194
Metal Market.—Fluctuations in July	195
Electric Tramway and Railway Exhibition, 1905 (*illus.*) (*cont.*)	195
Parliamentary	199
Economy in Boiler Plant	203
New Patents Applied For	204
Published Specifications	204

THE

UNIVERSAL ELECTRICAL DIRECTORY

1905 Edition

NOW READY.

PRICES (POST FREE) IN

United Kingdom.. .. 14s. | U.S.A. (duty free) .. 18s.
British Colonies.. .. 15s. | Other Countries .. 16s.

Order at once.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone No. 933 Holborn; 4425 Central.

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, AND HAS

BY FAR THE LARGEST CIRCULATION
of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—In Great Britain, Post Free, per Year, 19s. 6d. To all other countries, per Year, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street Paris: VEUVE J. BOYVEAU, 22, Rue de la Banque. Berlin: ASHER & Co., 13, Unter den Linden.

Cheques and Postal Orders (on Chief Office, London), to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE L. & Y. DISASTER.

THE deplorable accident which took place on Thursday last week at Hall Road, on the Lancashire and Yorkshire Railway Co.'s Liverpool-Southport electrically-equipped railway, is another of the occurrences that from time to time startle the public, and illustrate, *inter alia*, the absolute dependence of the railway service upon the individual. The occurrence is the first in this country in which a collision leading to loss of life has taken place between electrically-driven trains and, whilst we sympathise to the fullest extent with the unfortunate victims of the accident and their friends, it is some satisfaction to note that the accident was in no way attributable to the electrical equipment of the line. The circumstances attending the occurrence, and the signalman's frank confession of error, put the matter beyond doubt.

As the coroner's inquiry stands adjourned to the 10th inst., and the Board of Trade inquiry was only commenced on Tuesday last, it is not desirable to discuss or comment on the actions of any person who may be held to be responsible for the accident, the more especially as the coroner, when addressing the jury, intimated that one of the questions they would have to consider would be the degree of culpability of the person found to be at fault. Nevertheless, a recapitulation of the main facts connected with the event will be useful in showing that the disaster was due, primarily, to the same cause that has led to previous accidents, namely, to failure of the human element of control.

The accident occurred to the 6.30 p.m. train from Liverpool, which was fairly well filled with passengers. The train seems to have passed the Hall Road distant signals at "danger" in the ordinary course, and on arrival near the signal-box the driver was called forward by a hand signal given by the signalman, who appears to have been under the impression that his mechanical signal was out of order. At the time, the points over which the train had to pass to continue its journey were set for a siding in which another train was standing. The fact that the points were in this position would be plainly evident to the signalman by the position of the lever controlling them, and was further evident from its locking the signal, by which he should have given permission for the train to proceed, in the "danger" position. Notwithstanding these plain indications, the signalman seems to have jumped to the conclusion that his inability to lower the signal required was due to the interlocking mechanism of the signals, &c., being out of order, and without verifying the assumption, or examining the position of the levers controlling the operation of the signal lever, through the interlocking, he gave the fatal hand signal to the driver to proceed, with the result that 20 persons were killed and others seriously injured.

The signalman's own statement concerning the occurrence is as follows :—

I very much regret to say that I turned the 6.30 p.m. from Liverpool to Southport on July 27th into the middle siding.

I had my outer and inner distance signals at danger, and on the train approaching, I lowered my home and advanced signals for the main line, and gave the driver a green flag to go ahead.

At this time the points were set for the middle siding. When I gave the driver the hand signal to go right away I was under the impression at the time that the N 37 signal was out of order.

I deeply regret my error in this instance.

Read between the lines, this is a most pathetic statement. Considered from a technical point of view, it illustrates the ease with which the most elaborate precautions to ensure safety may be made of no avail. What the condition of the signalman's mind was at the time to cause him to misinterpret the plain indications afforded by the apparatus under his care, or what were the precedent events which may have contributed to that state of mind, there is as yet no evidence to show, and it is not our province to inquire. There are a number of points in the descriptions given by the daily Press which are not at all clear, and which are contrary to ordinary railway practice. A discussion of these points, however practically they may bear upon the events leading to the accident, would be prejudicial to those concerned, and is, therefore, inadmissible at present. Under the close scrutiny to which the occurrence will be subject in the course of the Board of Trade inquiry, it is quite certain that all particulars will obtain full publicity and that the blame will be fairly apportioned.

Leaving this part of the subject for the present, one notes with satisfaction the eminently sensible remarks of the Coroner with respect to the electrification of the line and the apparent endeavour by certain anonymous persons to prejudice opinion against electric traction, or to connect the accident with the fact that electricity was employed to furnish the motive power. However remote may be the connection, or however absurd the implication of connection may be to the technical man, there are always numbers who are misled by such stories, no matter how foolish, improbable, or exaggerated they may be. In this case the evidence is so plain as to require no confirmation.

The accident was not due to any system of traction, and would have taken place as readily with steam traction as with electric. Nor was it due in any way to lack of apparatus on the part of the company ; the evidence already available shows that the signalling apparatus is completely up to date, and was in good order at the time of the occurrence. As in so many cases, as shown by the Board of Trade inspectors' reports during the last 30 years, the accident was entirely due to the failure of the weakest link in the chain of signalling. The weakness of this link has been pointed out in these columns again and again.

The Need of a Buffer Car.

Apart from all questions as to the cause of the disaster on the Lancashire and Yorkshire Railway, one fact appears prominent, and that is, that passengers were carried at the very front of the train, with neither locomotive, tender, nor even a guard's van interposed between them and the object run into. Of 25 people in the first car, 20 were killed outright and the others injured, and just as long as passengers are thus carried right in the forefront of a train shall we see what might otherwise be slight accidents develop into seriously fatal ones. It has long been known that the engine is a great protection to the train behind it, and the interposition of the guard's compartment has often helped to moderate the effect of a collision on the following carriages. Something has to smash when a heavy train is brought too quickly to a standstill, and nothing better is known so far than a front carriage. This the accident strongly proved, for very little harm happened behind the first car. The only faulty thing was that passengers were carried in this leading car, and they also were smashed with it. The facts have been all too obvious for more than half a century, yet nothing has been done, and in the commencement of electric railway traction it seems regrettable that no steps have been taken in this direction.

Every train should have an empty leading car. It would require, of necessity, to be as heavy as the cars behind it, and might be constructed with a special filling of wood or wicker or springs capable of being crushed up by the following cars, which would be brought somewhat gradually to a stop. It may also be argued, not without reason, that the framing of the front buffer car should be so arranged that it should not telescope over, but under, the frames of the following cars. With this extra length of buffer car, the platforms of wayside stations need be made no longer than they are at present, for the front car could always be overrun.

It is possible that those who believe in having a locomotive at the head of a train will find in this accident an opportunity for pushing their views. We are aware that some engineers do not approve of a train being propelled entirely by its own wheels. This question we need not stop to discuss at length. The opinion exists, and is at least entitled to consideration. It may be based only on habit—on a mental bias against changing the system of haulage—but those who uphold self-motive cars must be prepared to meet objections to them. But whatever be done, the front and the rear of every train require some sort of a buffer car to take the shock of front or rear collision.

Since writing the foregoing we have received information that this question has been raised in the House of Commons by Mr. Marshall Hall, who asked the Secretary to the Board of Trade whether he would consider the advisability of making it compulsory for all electric trains to be provided with a buffer or empty carriage in the front, and of issuing further regulations with regard to the use of facing points. Mr. Bonar Law replied that both these questions would be taken into consideration.

Telephone Etiquette.

The letter of "Telephone," published in our issue of July 28th, draws attention to what is really one of the chief difficulties in the working of the telephone service in London —the extraordinarily careless and inconsequent manner in which the service is often worked from the subscriber's end of the line. The average telephone subscriber is willing on all possible occasions to ventilate his grievances as to getting "wrong numbers," being prematurely "cut off" from the right one, or being told that the number wanted is "engaged." But although these defects in the service occur, and, doubtless, will continue occasionally to occur until humanity and machinery both become infallible, it is too often overlooked that by far the larger proportion of the friction which occurs in the daily working of the telephone service is due to the totally unintelligent manner in which the service is handled by many subscribers or their representatives.

The experience of "Telephone," asked in succession by four different people to state who he was and what his business was, is not only not uncommon, but is so familiar to us all that doubtless it is repeated thousands of times a day in London alone. The drag on the whole service, the waste of valuable time, and the exasperation caused by the London telephone subscriber's habit of entrusting his telephone service to the crass stupidity of the average office boy, largely detract from the general value of the service to the public. It is shocking to contemplate the economic waste which arises from the continual mishandling by a large proportion of the users of a complicated organisation and service dealing with an average daily traffic of some half a million calls. The lack of intelligent operation of the public end of the telephone service is so widespread, that we fear it will be necessary for the National Telephone Co. and the Post Office to undertake a systematic campaign of

education of the telephone-using public, to effect any general improvement. Yet one would think that the natural intelligence of the ordinary business man would be equal to grasping the fact that it is contrary to his own interests to allow his customers and correspondents to be insulted and annoyed by impertinent and slipshod speech and methods on the telephone. There is too much tendency to regard the telephone merely as a machine, and to ignore the fact that a telephone call means that there is a human being—very often of the most important type, a customer—at the other end of the line. As a result, the caller by telephone is often treated to a slovenly lack of attention which would scandalise the most rough and ready business man if shown to a caller in person.

The intelligent way to use the telephone service is to use it as directly as possible. Telephone calls are generally as important as letters and telegrams—often much more so—and no business man dreams of deputing a raw office boy to receive and answer letters and telegrams. In any well-organised office it should be the duty of a well-trained and responsible clerk to answer the telephone, one who appreciates the advantages of courtesy, and of sufficient intelligence to understand that to transfer a call to a second person, without also passing on the name of the caller, and whatever message has been received, is both discourteous and time-wasting. If an office boy *must* be employed to handle the telephone service, at least teach him to handle it efficiently—to use the instrument properly, to speak politely, and to take down names and messages accurately and pass them on quickly. And after having taught him these things, *see that he does them.*

The Campaign against Municipal Speculation.

But a few years ago opposition to municipal trading had for its ammunition mainly political theories, economic principles, and general experience of the common deficiencies of human nature. The three were enough to make some controversial impression on most men of business, but not to induce them to take active part, and, of course, on the bulk of the population there was no perceptible effect at all. Now, however, what may be termed the purely theoretical opposition to municipal trading has attached to its train a long array of disagreeable facts that make it much more formidable in its appearance. Merchants, manufacturers, and shopkeepers are actually feeling the pinch of high rates resulting from the careless borrowing and prodigal expenditure of local authorities, and at the same time the working classes, who were cheated into the hope of general municipal employment at fancy rates of wages, are finding it increasingly difficult to obtain any kind of employment. Consequently, such an institution as the Industrial Freedom League, the report of whose annual meeting is now before us in pamphlet form, rests on a much broader and more popular basis than at the time of its inception. Its work touches the everyday experiences of the people, and the absurd charge is no longer repeated that its purpose is to assist private electrical enterprise alone. We have in this pamphlet impressive warnings from seven or eight men of business of the very highest rank, whose public responsibilities make it incumbent on them to weigh well every word they utter, and whose knowledge has been gained in widely various spheres of activity; and what these representative men express, together with the approval of those who give only silent support to the League, is practically the unanimous opinion of the managers of England's industry, that unsound municipal speculation is threatening the foundations of our prosperity. The speeches here reported are so closely reasoned and stored with important evidence that we cannot fairly attempt to make extracts. All we can do is earnestly to recommend their study, and at the same time to wish more power to the League, whose secretary, Mr. P. S. Bridgeford, is entitled to high praise for the discretion and perseverance he has shown in the face of senseless abuse and demagogue denunciation from parties whose personal interests oblige them to fight desperately for the continuance of heavy municipal expenditure.

Russian Electrical Trade.

H.M. Consul at Moscow, Mr. Grove, in his report on the trade in his district in 1904 again deals with some of the factors which restrict British trade with Russia. These are oft repeated, and seem to fall on absolutely deaf ears. There is the complaint that it is almost impossible to induce British manufacturers to make minor alterations to suit local taste or necessity. The British manufacturer, also, does not offer the same inducements that are offered by his German rival of long credit, quotations in Russian weights, measures, coins, and language. There is the usual British dumping of British catalogues with British descriptions, weights, measures, and coinage. The Consul suggests that if it is impossible to prepare catalogues in Russian as is done by some British firms, lists and prices in German may be sent, and are more likely to be understood than those printed in English. Electrical manufacturers will be glad to learn that the employment of electricity is rapidly increasing in Russia. They will not, however, be so glad to learn that Germany seems to have the lion's share, both as regards getting the big contracts for electrifying railways, and for supplying all sorts of plant. The installation of electric lighting, together with conversions from horse to electric traction, is taking place in several towns, but everywhere it is being done by German firms. Of the total imports of electrical plant and appliances, more than three-fourths come from Germany, and only a very small fraction from the United Kingdom.

The Telephone Agreement.

The Telephone Committee appointed to consider the agreement between the Postmaster-General and the National Telephone Co. has issued its report, an abstract of which appears on another page. It finds that the policy of purchase is to be preferred to other alternatives, and it, therefore, recommends the adoption of the agreement with certain modifications, of which the most important are :—

That municipal licences can be granted between August 31st, 1905, and December 31st, 1911, without giving the National Telephone Co. rights to compensation under the Telegraph Act of 1899.

With regard to the staff, the Committee recommends that all officers and servants who have been not less than two years in the service of the company on December 31st, 1911, shall be taken over by the Post Office.

Officers and servants not participating in the pension scheme of the company, but who would be on the established list if they were in the service of the Postmaster-General, shall be entitled to count their past years of continuous service with the company, subsequent to 1909, as years passed in the Civil Service of the Crown.

From August 31st, 1905, the company should be required to submit all candidates for service to the same medical examination as the Government service would require. Employés now in the service of the company, if taken over by the Post Office, should not be required to submit themselves to medical examination.

It would seem that the reasonable efforts of the staff to improve their prospects have resulted in some satisfactory recommendations.

The other recommendation to which we have referred may be regarded as a concession to the municipal idea, and an indication that the Committee has not clearly grasped the requirements of the telephone service. We do not attempt to forecast the attitude of the Postmaster-General or of the company upon this recommendation, but it is easy to see that it is of little practical importance. We cannot conceive of any additional municipalities embarking on telephone enterprise after 1905, and it is still more difficult to conceive that the Postmaster-General should, say, in 1907, license a municipality whose business would be conducted in competition with the licensor after 1911. The reason for the recommendation is, as we have said, not very intelligible, but we do not doubt that the Postmaster-General will know how to deal with it.

JOHNSON-LUNDELL REGENERATIVE SYSTEM OF ELECTRIC TRACTION.

On Thursday last, by the courtesy of the Johnson-Lundell Electric Traction Co., Ltd., we were enabled to visit their new works at Southall, and to witness tests of the performance of a dummy car equipped with the Johnson-Lundell regenerative system of motors and controllers. The equipment behaved exceedingly well, running round a circular track on the premises of the company, at speeds ranging up to 17 miles per hour; the acceleration was smooth except for a slight jerk at starting, due to a cause explained below, and no fault could be found with the running at steady speed. When it was desired to stop the car, regeneration commenced at once, without excessive rush of current, and continued at a high value down to a remarkably low speed—certainly not more than 2 miles per hour; speeding up and checking the car, as though making progress at low speeds through crowded traffic, were accomplished with ease, the checking being applied purely by the regenerative action of the motors, which could easily be observed on the ammeters. As with all regenerative systems, a mechanical brake was necessary, to pull up the car to a dead stop and hold it on an incline, and this took the form of an automatic brake, which came into action when the controller was put to the stop

Fig. 1.—Parts of Johnson-Lundell Regenerative Motor.

position, but was relieved directly the controller was put in operation again. The brake could also be applied instantly in emergency by the movement of a switch.

The Johnson-Lundell system is based *essentially* upon the use of the series-parallel principle; in fact, this is carried a stage further than usual, the motors in the equipment shown having double-wound armatures, with two commutators each, and all four armature windings being connected in series at the lower speeds. Four motors, however, could equally well be used, and it is not absolutely necessary to have more than two commutators.

Thanks to the double series, and the use of strong fields, the usual main circuit resistances can be dispensed with; series resistance is used only on the first starting step in order to avoid a jerk in starting (the slight jerk noticed last week was due to this resistance having been made too small). Moreover, when regenerating, the same factors enable the process to be continued almost down to a standstill. In order to facilitate the obtaining of the most powerful fields, the most rapid response in variation of field strength to changes of excitation, and perfect equality of E.M.F. between the two motors, the field-magnet cores and yokes are laminated throughout, in accordance with designs of Mr. Lundell, which secure mechanical rigidity independently of the laminations. Figs. 1 and 2 show the parts of the motor, which looks somewhat different from the ordinary type, but is of about the same size, and weighs 2,100 lb. for a rating of 37½ H.P. (the size used for the demonstration).

Thanks to the elimination of the main circuit resistances, the transition from motoring to generating takes place with a very small change in speed, or in field strength, and as the generating functions are regulated by the main controller, starting from the highest step, regeneration commences at the maximum speed attained, whatever it may be, and continues down to walking speed, being all the time under full control.

In the earlier days of the Johnson-Lundell system (our readers will remember that it was experimentally in use in Newcastle in 1902), the motors were compound-wound, both when generating and when motoring. In a report on the above-mentioned trials, Mr. H. F. Parshall pointed out that whilst the input was 15 per cent. less than with the series-parallel system using series-wound motors, and the

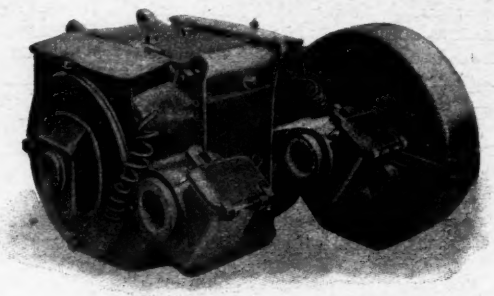


Fig. 2.—Complete Motor and Gear-Case.

regenerative function restored 25 per cent. of the input to the line, the loss in the shunt winding when motoring amounted to 15 per cent. of the input, thus neutralising the advantage derived from double-series paralleling.

To overcome this drawback, the engineer of the company, Mr. Gustaf Lang, whose enthusiasm and resourcefulness are only equalled by his courtesy, invented a modification of the original system which constituted a very important forward step. The following is a brief description of the system devised by him.

Mr. Lang decided from theoretical considerations that the machines must be pure series motors when accelerating and running, and compound generators when regenerating. To accomplish this object without having idle copper on the fields at any time, he sub-divided the fine wire windings in such a way that they could be grouped in parallel and used as series windings, as shown in the accompanying diagrams.

The permanent series windings are few in number, and when regenerating they act in opposition to the shunt windings; it might be thought that this implied waste of copper,

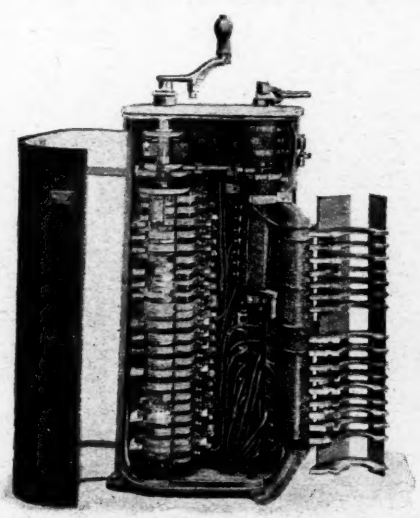


Fig. 3.—Platform Controller.

but in practice it is found to be a highly advantageous arrangement, preventing sudden heavy rushes of current when regenerating.

The radical changes of connections necessitated by the system outlined can be made in the main controller, and were, in fact, originally made in this way; it is preferred, however, to perform the grouping of the shunt coils with the aid of a separate "field changer," which is normally held by a spring in the position which gives the motor a series characteristic. When it is desired to bring the compound winding into action for regenerating, a button is

pressed in the handle of the controller; this closes the circuit of a solenoid, which pulls the field changer into the compound position. Any failure in the solenoid circuit merely releases the field changer, and allows it to resume the series position, under which condition the car can be operated exactly like any ordinary car, but retaining the advantage of double series-paralleling.

It is important to note that the whole of the control is effected with the one controller handle; this is made clear by the accompanying diagrams of connections.

Diagram I. shows the successive arrangements whilst accelerating; *every* notch except the "starting" notch is a running point, with full efficiency. The connections are as follows, the fields being series wound :—

*	Starting.	Four armatures in series,	resistance in.
*	Notch 1.	" "	full fields, no resistance.
	" 2.	" "	fields shunted.
	" 3.	" "	fields further weakened.
*	" 4.	Two armatures in series,	full fields.
	" 5.	" "	fields shunted.
	" 6.	" "	fields further weakened.
*	" 7.	Four armatures in parallel,	full fields.
	" 8.	" "	fields shunted.
*	" 9.	" "	fields further weakened.

* These positions are shown on Diagram I.

Passing to the regenerating condition, Diagram II. shows the connections and steps; the transition from "notch 9 accelerating" to "notch 9 regenerating," with the differential compound characteristic, is effected purely by pressing the button in the controller handle :—

*	Notch 9.	Four armatures in parallel,	fields weakened.
	" 8.	" "	stronger fields.
	" 7.	" "	full fields.
*	" 6.	Two armatures in series,	fields weakened.
	" 5.	" "	stronger fields.
	" 4.	" "	stronger fields.
*	" 3.	Four armatures in series,	fields weakened.
	" 2.	" "	stronger fields.
*	" 1.	" "	full fields.
*	Starting.	" "	resistance in main.

* These positions are shown on Diagram II.

It will be noticed that the series coil is permanently shunted (when regenerating) with a resistance; there is no resistance in the main circuit except on the "starting notch," at walking pace. The shunt coils are connected

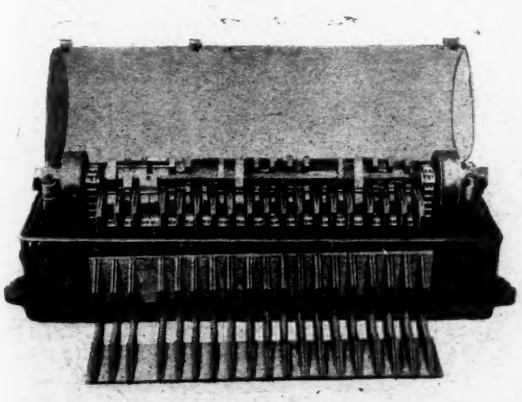
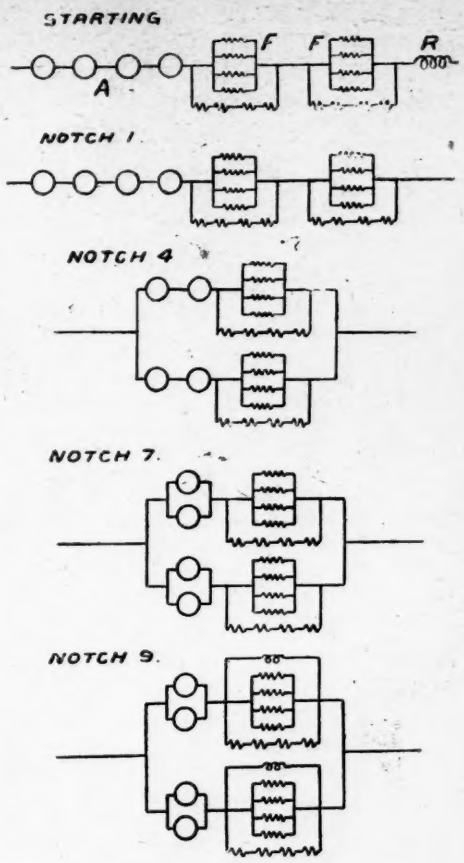


Fig. 4.—Field-changer.

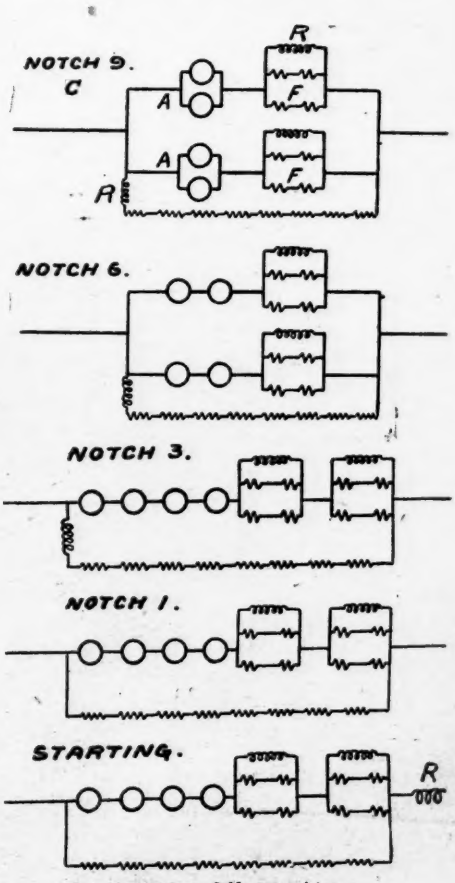
across the outermost terminals, so that the motor fields are equal. It will be seen that the connections are by no means so complicated as might be anticipated. The field changer (fig. 4) is situated in the truck between the motors, and the connections therewith are short. Excessive currents returning to the line, with the resulting jerks, are prevented by the differential winding, and both the acceleration and the retardation were observed, whilst riding on the car, to be smooth and gradual, under all the varied conditions that could be devised by Mr. Johnson, who captained the car.

The effect of holding the handle fixed on one of the notches when regenerating is simply that the speed falls



A, armatures; F, fields; R, resistance.

Diagram I.—Connections whilst Accelerating or Running.



A, armatures; F, fields; R, resistance.

Diagram II.—Connections whilst Regenerating.

until the motors change their function from generating to motoring, and the car runs on steadily at a definite and constant speed, the only difference from normal running being that the efficiency is somewhat lower. Directly the regenerative button is released, the field changer restores the normal series characteristic. The variation of the shunt excitation is effected by extra fingers on the platform controllers, which are brought into play by the field changer, the fingers which vary the series excitation when accelerating being simultaneously put out of action. The platform controller closely resembles the ordinary series-parallel type, with the afore-mentioned modifications, and is no larger (fig. 3). The field changer was exposed to view during the demonstration, and it was noticed that there was practically no sparking when changing the connections, due to the fact that the fields are always partially maintained by series winding. The abandonment of the compound winding for acceleration greatly simplified the design and improved the proportioning of the field windings, besides rendering it possible to operate the car with one motor in case of need.

The automatic mechanical brake gear, which was devised by Mr. E. H. Johnson, calls for special mention. Obviously, regenerative braking cannot alone suffice to hold a car at rest on a grade, nor to bring it quickly to a dead stop on the level. In order to prevent overlapping of the two functions, Mr. Johnson has arranged his brake so as to

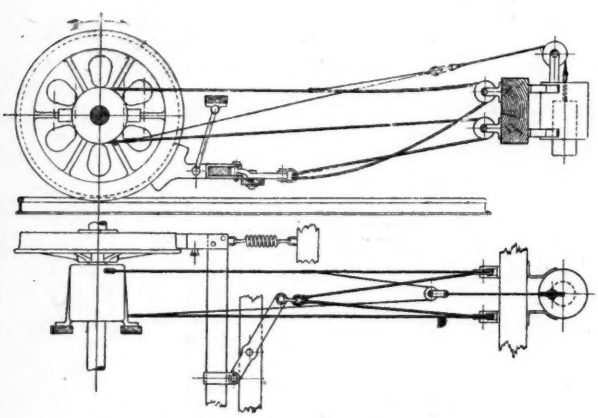


Fig. 5.—Johnson Automatic Brake Gear.

come into action when, but not before, regeneration ceases. The brake is electrically controlled, but is applied by power derived from the car axle. Fig. 5 shows the gear in elevation and plan, as applied to the ordinary wheel brake system ; it can equally be adapted to track brakes, and the brakes can in any event be operated by hand also.

Two stout steel cables are led from the end of the braking lever to the ends of a spiral friction band on a drum fixed to one of the axles. Normally the band is open and free, but when both ends of it are pulled, it binds on the drum and puts the brakes on, no matter which way the car may be running. This necessary pull is exerted by a weight, attached as shown to a pulley, round which passes a cable connected with the ends of the friction band. The weight is supported by a solenoid, which is controlled by contacts in the platform controller, and comes into action whenever the controller handle is moved to the starting or any other active notch. Putting the controller to "stop" releases the weight and puts on the brake ; moreover, *any accident whatever* causing interruption of the electrical circuit immediately puts the brake full on without the intervention of the driver. The force with which the brake shoes are applied to the wheel depends upon the magnitude of the controlling weight, and can therefore be adjusted to any desired value. A separate switch on the dash may be provided for breaking the circuit of the solenoid in emergency, and thus applying the brakes instantaneously.

Special attention is called to the claim that the characteristic feature of the equipment as a whole is that of the ordinary series-parallel arrangement, carried one stage further, and that the failure of any of the devices connected with the regenerative functions affects the latter only, thus leaving the reliability of the equipment unaffected.

From the foregoing it will be seen that the Johnson-Lundell system, as improved by Mr. Lang, possesses many interesting and novel features. The behaviour of the dummy car (which was loaded with motors weighing 4 tons, to bring up the weight approximately to that of an ordinary car) was all that could be desired, the slight jerk at starting being merely a matter for adjustment. The fact that regeneration took place when slackening speed on a level track was abundantly demonstrated, and the proper action of the mechanical brake was likewise observed.

Granting, then, the success of the demonstration, the question arises as to the prospects of the system under commercial conditions. The possibility—indeed, the complete practicability—of economising expenditure both upon energy and upon wheels and brake shoes by the use of regenerative braking has been fully demonstrated, as our columns have borne witness from time to time ; the more undulating the track, the greater is the economy effected, but even upon level tracks important savings can be made. The only matters outstanding, therefore, are the allied questions of reliability and maintenance. Taking into consideration the records of electrical operation of tramcars and railway trains, of which the former is really much the more arduous and trying to the electrical connections, there appears to be no reason to anticipate that difficulty will be experienced in connection with either the controllers or the motors. In the case of the latter, it is true that a shunt winding is more difficult to insulate satisfactorily than a series winding—but this has been accomplished by others. Given good workmanship and materials and competent supervision during construction and erection, the electrical equipment can certainly be depended upon. As regards the automatic brake, it is obviously impossible to set this so as to give the maximum braking power (*i.e.*, just short of skidding the wheels) under all conditions of rails and weather ; the brakes must therefore be set in accordance with the worst conditions of greasy rails, so that in no circumstances can the wheels be skidded. In case of need they can be applied by hand, when the driver will be no worse off than at present. We think, however, that no car should be wholly dependent upon one set of braking conditions ; when the wheels are used for electrical braking, as in this case, it is a great mistake to use them for mechanical braking also, thus absolutely staking the safety of the car upon the continued revolution of the wheels. The mechanical brake ought to be applied to the track, and might then be permanently set for the full braking power. The choice between wheel and track brakes lies with the tramway engineer ; the Johnson-Lundell Co. are willing to apply either, and consequently the drawback above mentioned is not inherent to their system.

We conclude, therefore, that there is no *primâ facie* ground for objection to the Johnson-Lundell system, while on the other hand, there are powerful arguments in its favour. The verdict can only be given after due trial under commercial conditions, and we hope soon to hear of the experimental adoption of the system by engineers who are in search of economy. While the actual saving must, of course, depend upon local conditions of running and topography, and therefore cannot be broadly stated, we may say that the company claim generally a saving due to the elimination of main circuit resistances of about 15 per cent. of the input ; a saving due to regeneration, with a schedule speed of 8 miles per hour and six stops per mile, of 20 per cent. ; and a saving due to gravitational regeneration, on the average, of 10 per cent., giving a combined economy of 40 per cent. on the ordinary input. In addition, there is, as we have on previous occasions explained, a saving in cost of generating plant and mains, and in that of wheels and brake shoes.

Lifts : Hydraulic and Electric. — The London Hydraulic Power Co. have issued a small pamphlet on lifts, advocating, of course, the hydraulic power lift as against the electric power lift, and they still further advocate the old ram type of lift as the safest of all. They regard the electric lift as a mere reversion to the abandoned steam winch. Supporters of the electric elevator may be expected to counter the claims made for the superiority of hydraulic lifts. It is a matter of common knowledge that electric lifts are far cheaper to run.

THE CONTINENTAL ELECTRICAL ENGINEERING INDUSTRY.

It is reported that the financial group associated with the Brazilian Electricity Co. have sold the latter's undertaking to an American syndicate for the sum of £850,000. The Brazilian company holds all the shares in the Villa Isabel tramway at Rio de Janeiro, and works the telephone service in the same city. Its share capital amounts to £250,000, of which the Berlin Electric Light and Power Investment Co. owns £64,000, in addition to having advanced over £185,000 to it by way of loan. It is, therefore, assumed that the Investment Co. is one of the principals concerned with the rumoured sale. Another matter in which the Investment Co. has interested itself is the proposed reorganisation of the Russian business of the Helios Electricity Co., but it is uncertain whether this will lead to any practical result. As far as the Helios Co. itself is concerned, it is stated that the balance-sheet prepared for the end of February shows a surplus of £30,000. It yet remains to be seen whether any of this sum will be available for distribution among the shareholders in view of the international engagements of this liquidating company, whose works have been purchased by the two leading German electrical groups. The position of the bondholders and bank creditors has, however, so far been secured that repayment will be made at the beginning of next year.

German Companies.

The Continental Co. for Electrical Enterprises (Gesellschaft für Elektrische Unternehmungen), of Nuremburg, which is the financial trust of the Schuckert Co., is now for the fifth time unable to pay any dividend on the share capital. A loss of £66,169 was incurred in 1901-2, of £21,007 in 1902-3, and of £34,350 in 1903-4, but for the past year the accounts reveal the meagre surplus of £260. The situation of affairs in the last two years is set out as follows:—

	1904-5.	1903-4.
Share capital	£1,600,000	£1,600,000
Interest receipts and profits from undertakings	135,960	121,880
Working expenses, taxes, &c. ...	9,785	15,563
Interest payments on bonds ...	19,407	19,800
Interest and bank charges	62,182	67,173
Renewal and capital redemption of undertakings worked by the company	20,401	19,127
Depreciation and loss on securities	23,925	34,567

The total outgoing charges for 1904-5 will be seen to amount to £135,700, thus leaving the small surplus already mentioned. Of the total share capital of £1,600,000 the Schuckert Co. holds £1,441,000, which is booked by the latter at one-half, namely, £720,500. The report of the directors of the Continental Co., which has to record the existence of a debit balance of over £93,000, refers in detail to the numerous undertakings in which it is financially interested or which are worked by the company. A larger revenue was realised from these enterprises, but the increase was almost counterbalanced by certain losses and by provision for depreciation that was found necessary in some cases. The liabilities of the company were considerably reduced by the profitable sale of a number of securities, while at the same time advances made to associated companies were repaid. A further diminution in the creditors is expected to take place this year, and, in fact, has already commenced.

The report for 1904 of the Accumulator Works Co. (Akkumulatoren Fabrik Act. Ges.), of Berlin and Hagen, which controls the Tudor battery in Germany, states that the volume of business increased from £425,000 in 1903 to £524,000 last year, and the improvement in the electrical industry made further progress. It was possible for the company to arrange with a number of competitors to abandon manufacturing operations, whilst an appropriate basis for the conclusion of sales was secured in other cases. The financial results of the subsidiary companies were favourable, although the war exercised a certain influence upon the Russian undertaking. The position of the parent company for the past two years is as follows:—

	1904.	1903.
Share capital	£312,500	£312,500
Net profits	47,020	53,014
Dividend, per cent. ...	12½	12½

The reduction in the profits was due to the increased expenses incidental to the larger turnover. The report states that the liquidation of the Pollak Accumulator Works, which were acquired by the company, was limited to the fulfilment of the battery maintenance contracts, and the business of the Oberspree factory, which is also the property of the company, has not yet been finally settled. At the previous year's meeting the directors were authorised to raise £100,000 temporarily, for the purchase of, or participation in, undertakings relating to the objects of the company. In accordance therewith some competitors were induced to discontinue manufacturing, and the company's investment in the Russian and English Tudor companies was increased. The necessary funds were to be provided by increasing the share capital by £87,500, the issue of which was sanctioned at the recent meeting. The accounts show that the value of the machinery, plant and patterns has been entirely written off. The orders on hand at the end of May represented £314,500, or £60,000 in excess of the corresponding period of 1904.

The directors of the Voigt & Haeffner Co., of Frankfort-on-Maine, in the course of their report for 1904, state that the programme commenced in 1903 was continued last year in regard to the construction of large apparatus, switches, safety appliances and regulators. This necessitated larger appropriations for bringing the manufactures on the market, whereas the results with the maintenance of the present situation of business would only be experienced in the current year. The same observation applied to a series of other products, and particularly in the case of two groups of apparatus of bulk production which are to be placed on sale this year. The financial results are as undernoted:—

	1904.	1903.
Share capital	£100,000	£100,000
Net profits	£4,772	£5,181
Dividend, per cent...	4	3

The available surplus, composed of net profits and balance brought forward, amounts to £5,158. The report points out that the sales increased by 30 per cent., mainly in consequence of the improvement in the inland trade. The prices remained at about the same level as in the previous year, and an advance could scarcely be hoped for, as the special nature of the company's manufactures would, perhaps, never allow of a combination for the purpose of placing prices on a rational basis. A further increase of 30 per cent. in the turnover has taken place in the first four months of this year.

The report of the Mix & Genest Co., of Berlin, which was approved at the recent general meeting, states that a further increase took place in the business transacted with private customers during 1904, but the deliveries for the Government authorities were less than in the previous year. Nevertheless, the net profits were in excess of those earned in 1903, as is shown below:—

	1904.	1903.
Capital	£180,000	£180,000
Net profits	£19,857	£18,339
Dividend, per cent...	7½	7

The net profits have been arrived at after writing off £9,788 for depreciation, as compared with £9,258 in 1903. The report pointed out that, owing to the large demands made upon the factory, it was necessary to erect an extension, and that the increase in the share capital, decided upon in February for this purpose, was being carried into effect. At the meeting of the company it was explained that the site for the proposed enlargement adjoining the factory had been found to be not quite suitable, and other sites were therefore being taken into consideration. The business transacted in the first four months of 1905 lead to the belief that satisfactory results will attend the operations of the company this year.

The International Electricity Co., of Berlin, which was formed in 1890 for the purpose of taking over the engagements of the Disconto Gesellschaft and the North German Bank in relation to the Popp Compressed Air Co., of Paris (Compagnie Parisienne de l'Air Comprimé), incurred a total loss of nearly £600,000 when the French concern was reconstructed in 1898, and as a consequence the German company proceeded in the following year to reduce its share capital from £1,500,000 to £750,000. It is now proposed to make a further reduction in the capital from £750,000 to £500,000 by the return of £250,000 to the shareholders. This has been rendered possible by the improvement in the position of the Paris company, which has been paying off floating liabilities, which are expected to be entirely extinguished by the end of the present year. The accounts of the Berlin company for 1904 show a surplus of £9,680 as compared with £11,454 in the previous year, and the former sum, as in preceding years, is to be devoted to writing down the value of the shares held in the French company. The latter's concession expires in 1907, and until the question of gas supply in Paris is settled, it is not expected that the negotiations between the Popp Co. and the Municipal Council with a view to an extension of the concession will lead to a definite result.

The Sachsenwerk, Licht und Kraft Actien-Gesellschaft, of Dresden, which acquired the manufacturing works disposed of in connection with the Kummer crash of two or three years ago, has now terminated its first complete year's working. In the course of the directors' report for 1904, it is stated that orders were received from the Imperial Navy, municipal authorities, shipbuilding yards and large industrial works, but, to a large extent, these could not be brought into account for the year, and, as a consequence, the turnover and gross profits were small in comparison with the expenses. The final result is a loss of £16,860, which becomes reduced to £11,500 by absorbing the paper balance brought forward from the period forming the initial year of the company's existence.

Swiss and Russian Works.

The Motor Co. for Applied Electricity (Gesellschaft fur Angewandte Elektricitat), of Baden, which is closely associated with Brown, Boveri & Co., earned net profits amounting to £23,637 in 1904, as compared with £13,308 in the preceding 12 months. The former sum has allowed of the payment of a dividend at the rate of 5 per cent. on a share capital of £400,000, as compared with 4 per cent. in 1903. In addition to being an investment company, and also operating electricity works on its own account, the company has now established a constructional department which has in hand power stations to be erected on the Lontsch, in the Canton Glarus, and on the Anza, in the province of Novara, Upper Italy. The share capital of the company is being increased to £600,000, for the purpose of developing the business in this direction.

The Swiss Electrical Industry Co. (Schweizerische Gesellschaft fur Elektrische Industrie), of Basle, which stands in intimate relations to the Siemens & Halske Co., of Berlin, is an investment company having a share capital of £400,000, in addition to a bond issue of £1,200,000. According to the report for 1904, there was no

inducement for embarking upon new business during the year. The advance of slightly over £240,000 to the St. Petersburg Electric Lighting Co. of 1886 was repaid, while the shares held in the Société d'Applications Industrielles, of Paris, were disposed of at a profit. The working expenses last year were higher, and the gross profits lower than in 1903, but by abstaining from making any provision for depreciation on investments, and omitting any appropriation to the reserve fund for syndicate business, the net profits are shown to be £34,574, as against £18,917 in 1903. A dividend at the rate of 5 per cent. has been declared, as compared with 3 per cent. in the previous year.

The record of the Russian Electrotechnical Works (Siemens and Halske) Co., of St. Petersburg, is represented by profits amounting to £43,277 for 1904. After writing off the deficit from the previous year, and providing for depreciation and reserve funds, there remains a balance of £4,856, which has been carried forward. The heavy electrical engineering department, in so far as concerns the supply of plant to private undertakings, experienced a considerable decline, but compensation was obtained in larger orders for the purposes of the war. The directors state that it is difficult to judge the prospects for the current year, although the higher import duties are expected to enhance the company's turnover. At the same time, the economic and political movements may affect the results for the year, as it cannot be seen what new burdens may be imposed upon trade as a consequence of those circumstances.

The Russian Felten & Guilleaume Co. (Rieben cable factory) has again experienced an unsatisfactory year. In 1902 there was a loss of £14,577, and in 1903 one of £7,945, while for 1904 a further loss of £38,629 has been incurred. Including earlier losses, the total deficit amounts to £69,300, although this has been reduced to £46,650 by absorbing the reserve fund. The depreciation in the position of the company is materially attributed to the amalgamation of local companies of German origin, with the result that the large orders for installation cables which were formerly placed with the Felten & Guilleaume Co. have been transferred to the amalgamated company. It is said to be questionable whether full compensation would be obtained by a combination of the F. & G. Co. with the Lahmeyer Co., as the latter's Russian business is not of very considerable importance.

LEICESTER TRAMWAYS: COST OF CONSTRUCTION.

Short mention was made of Mr. Mawbey's report in our issue of June 9th, but it is worth a further note.

In the first place, it is refreshing to find a place where the Parliamentary estimate has not been exceeded; and that, in spite of an expenditure of £13,000 (2·8 per cent. of the total) on "miscellaneous" items, which, we suppose, is equivalent to the "contingency" item inserted in most estimates, and a 28 per cent. increase in cables laid over cables estimated.

A large number of extra spare ducts were laid, and the wisdom of this provision is evident already, as it appears that the traffic has outrun the estimate, although the tramways have been opened for a few months only.

The total expenditure to date is made up as follows:—

Purchase of old lines (Garcke's Manual)	...	£134,000
Cost of reconstruction and new lines ...	...	470,000
		£604,000

The length of single track is 36½ miles, so the cost per single track mile is £16,500, while the average cost per mile of all tramways and light railways in Great Britain, according to the B. of T. return 1903-4, is £16,000; but that return includes some 300 miles of steam and horse tramways on which the capital expenditure did not exceed an average of £8,000, so that the cost of the Leicester tramways compares favourably with the average, and is much below a few undertakings of similar size. Nevertheless, if we are to believe the figures compiled by the *Electrical Times*, the capital cost per mile is much lower than £16,500 in many municipal undertakings with over 20 miles of single track, but this is accounted for generally by the cost of a generating station being excluded.

The following table gives the total expenditure per single-track mile of 10 municipal undertakings with separate traction power stations:—

	"Electrical Times."	"Tramway and Railway World."
Birkenhead	£14,700	£14,459
Bournemouth	15,600	12,678
Cardiff	24,700	28,160
Glasgow	15,000	19,800
Huddersfield	11,700	11,398
Hull	14,000	16,369
Leeds	13,500	12,558
Newcastle	23,500	21,985
Portsmouth	22,000	21,725
Sheffield	16,500	15,735

The first column is an approximation from the figures of total capital expenditure and miles of single track as published in the last supplement of the *Electrical Times*, which gives the figures for 1904, while the second column is taken direct from the table of records published in the *Tramway and Railway World* of April 4th, 1904, giving the figures for 1903. We make no attempt to explain the discrepancies in the two columns relating to Cardiff, Glasgow, and Hull, but we should be glad to know which figure is right in each case, for it is obvious that the total capital expenditure will not be greater in 1903 than in 1904. We must assume, too, that in all cases the total cost includes the purchase price of the old undertaking whenever that existed.

Leicester, with £16,500, does not compare so well in the light of these figures. The enormous cost of the Cardiff, Newcastle, and Portsmouth concerns looks very bad, but the remainder are lower than Leicester, and Huddersfield is quite remarkable, so that the Leicester Corporation would not seem to have quite so much to congratulate itself upon as the wording of the report might lead us to expect.

An analysis of the cost per mile of the various portions of the tramway scheme may help us to a better understanding on this matter.

Permanent way	£5,900 approx.
Cables	800 ,,
Overhead	1,100 ,,
Power station and plant	1,810 ,,
Car-sheds	930 ,,
Cars	1,450 ,,
Land for buildings	280 ,,
Public works charged to tramways ...	300 ,,
Miscellaneous	350 ,,
Total	£12,900 ,,

The engineer makes a point of mentioning—not unnecessarily, we fear—that the tramways have been charged with everything that ought to be charged against them, including street improvements, salaries of borough engineer's staff employed, consulting engineer's fees, purchase of land, alterations to and reinstatement of roads outside tramway margins, and compensations.

It is hard to take exception to any of the costs above, unless it be in the direction of power station and car-sheds, but the engineer explains that the power plant is in excess of present wants.

If 90 double-deck single-truck cars were bought for £53,000, a good bargain was made.

The permanent way was constructed by the Corporation, and is probably the best of its kind in England; but we do not relish the idea of permanent way construction being carried on at full swing all the winter, as had to be done at Leicester owing to the acuteness of the unemployed situation, and we hope that the concrete will not suffer.

No provision was made in the estimates for temporary track for keeping the horse-car service running during reconstruction, and that strikes us as an oversight, for we cannot conceive that the Corporation proposed to shut down that public service for such a length of time.

Credit is taken that the cost of permanent way was £478 per mile less than the Parliamentary estimate, but it would have been endorsed more freely by outsiders if that saving had been made over the lowest of a set of competitive tenders.

Credit not only is taken but is due to Leicester for proving by deeds, as so few have been found willing to prove hitherto, that every bit of the plant which goes to make up a tramway is purchasable in England of English makers; and that, when every tenderer has to comply with identical specifications and conditions of contract, it is not often that the British manufacturer is beaten.

THE TREATMENT OF ELECTROLYTIC SLIMES.

In a recent number of *Electrochemical and Metallurgical Industry*, Mr. A. G. Betts describes an electrolytic process which he has devised for working up electrolytic copper or lead slimes, the materials in question presumably containing gold, silver, copper, bismuth, antimony and arsenic.

The principal reagent is a solution of ferric sulphate, which is obtained later on in the process when the copper is thrown out. This liquid contains 4 or 5 per cent. of iron as ferric sulphate, 0·5 to 1 per cent. as ferrous sulphate, 1 per cent. of copper as sulphate, and from 4 to 6 per cent. of free sulphuric acid. The solution is first agitated by means of a jet of steam and air in a lead-lined tank with copper oxide, copper scale, or similar material, in order to neutralise the uncombined acid; and then the slime is introduced, in the proportion of 100 lb. for every 22 cb. ft. of liquid. Chemical reactions proceed rapidly, the copper, lead, and silver being converted into sulphates, the arsenic, antimony, and bismuth into sesquioxides, while the ferric sulphate is reduced to the corresponding ferrous salt and free sulphuric acid. Plates of metallic copper are next hung in the fluid mixture to precipitate the silver, and after waiting for several hours for this action to be completed, the whole is passed through a filter press. It is possible to leave the silver in the liquid, precipitating it with copper subsequently; but the latter method gives a very voluminous deposit, which is contaminated with antimony and arsenic. From the filter press a liquid is obtained which contains copper, arsenic, and ferrous sulphate; this is electrolysed in the manner described lower down. The filter cake is washed free from copper and iron, the washing liquors being passed over scrap iron to retain the copper, and then run to waste. It does not pay to evaporate this liquid, as ferrous sulphate is so cheap; moreover, if there is not enough arsenic in the slime to be worth saving, a wastage of 10 per cent. of the

original ferric solution keeps the proportion of arsenic in the liquid which has to be electrolysed down to 1 or 3 per cent. eventually, and so allows the copper to be deposited in a perfectly pure state. Arsenious acid is soluble in about 10 parts of the hot solution, and in 100 parts of the cold; so that, if necessary or worth while, the arsenic may be recovered before electrolysis by crystallisation. The washed filter cake is next extracted in a lead-lined tank with a solution containing 2 to 4 per cent. of sulphuric acid, and 12 or 15 per cent. of hydrofluoric acid (this is also the by-product of a subsequent electrolysis). In the course of four or five hours 90 per cent. of the total antimony present dissolves, leaving a residue of gold, silver, and bismuth, which is collected on a filter cloth and dried. This residue is mixed with one-quarter or one-third its weight of soda ash, and melted down to a "bullion" containing the gold, silver, and bismuth of the original slime, the bullion being finally parted electrolytically.

The copper and iron solution is electrolysed in a cell provided with diaphragms constructed of cypress wood in which holes plugged with asbestos wads are drilled. The liquid is fed to a channel running longitudinally on one side of the cell, whence it runs to the cathode compartments; from the anode compartments it passes to a similar channel on the other side of the vessel, whence it is siphoned off ready for neutralisation with copper oxide once more. By this arrangement the level of the liquid at the exit is a little lower than at the inlet to the cell, and so a sufficient flow through the asbestos is maintained. In each channel there is a paddle-wheel agitator. The anodes are ordinary arc light carbons, although Acheson anodes work better. The antimony trifluoride solution is electrolysed in a lead-lined tank between sheet-lead cathodes and rod lead anodes, with a cathode density of 10 to 20 amperes per sq. ft., an anode density of double that amount, and with a voltage of 2·6 to 2·8. There is a tendency to the formation of antimony pentafluoride at the anodes, but when they are protected by a layer of cotton cloth, the current efficiency of the process is as high as 92 or 95 per cent. The deposit is dense and solid, free from "trees," and contains about 1 per cent. of bismuth. Its purity, of course, depends on the care with which the original filter cake has been washed. The residual liquor is the solution used for the lixiviation of the filter cake, as mentioned already.

The "bullion" is parted in an acid solution of silver methyl-sulphate (methane-sulphonate), containing, preferably, one part of gum arabic or gelatin per 12,000 or 15,000 parts (to render the silver deposit solid). The bismuth of the anodes passes easily into solution along with the lead, copper, silver, and traces of antimony, and it may accumulate to the extent of 4 or 5 per cent. without any danger of yielding basic salts. The solution can be electrolysed for 48 hours without formation of trees. The silver deposited can be scraped from the sheet silver cathodes, so that the latter may be used several times. When the quantity of silver in solution is reduced to about 1·5 per cent., it is replaced by a fresh batch; the residual silver is thrown down by means of metallic copper, the copper and bismuth by metallic lead, the methane-sulphonate of lead decomposed with silver sulphate, when the resulting silver methane-sulphonate is ready to be used over again. The precipitate of copper and bismuth can be treated with ferric sulphate to remove the copper, and the bismuth oxide can be reduced by fusion.

For a slime containing 1 per cent. each of antimony and silver, 0·5 per cent. of copper, 0·25 per cent. of arsenic, 0·2 per cent. of bismuth, and 1 oz. of gold per ton, Mr. Betts calculates the cost of his process per short ton to be $0·97, as follows:—Reagents, ferrous sulphate, 24 lb. (5 per cent. daily loss), at $5 per ton, 6 cents; sulphuric acid, 9 lb. at 1 cent., 9 cents; soda ash, 10 lb. at 1 cent, 10 cents; nitric acid for gold, and loss in silver solution, 5 cents; loss of hydrofluoric acid, 1 lb. at 3 cents, 3 cents; total, 33 cents. Power for depositing 20 lb. of antimony, 18 KW.-hours; for 52 lb. of copper and equivalent ferric sulphate, 25 KW.-hours; refining 20 lb. of silver, 1 KW.-hour; total 44, at $30 per H.P.-year, equals 20 cents. Steam for heating solution, coal for melting antimony and silver, supplies and repairs, together 19 cents. Labour, 10 men, 25 cents. Grand total, $0·97 per ton. The copper oxide required is not charged, because it is recovered as electrolytic metal, and so represents a profit rather than a loss.

Wages for Beginners in America.—The following note from our esteemed exchange, the New York *Electrical World and Engineer*, will interest many young electrical beginners on this side; but when comparing American wages with those prevailing in this country for similar employment, they would do well to bear in mind the higher cost of living on the other side:—The General Electric Co., which is looking for apprentices at its West Lynn factory, in response to inquiry, announces the following salaries:—To graduates of high schools only—drawing office apprenticeship course, $5.33 per week for first six months, $6.30 per week for second six months, $7.28 per week for third six months, $8.25 per week for fourth six months, $9.22 per week for fifth six months, $10.67 per week for sixth six months. There will also be a bonus of $75 distributed if the three years of service have been satisfactory. Shop apprenticeship course—$4.48 per week for first six months, $5.60 per week for second six months, $5.72 per week for second year, $7.84 per week for third year, $9.24 per week for fourth year; bonus of $100 at expiration of term if services have been satisfactory. For high school students and grammar school graduates—shop apprenticeship course—$3.36 per week for first six months, $4.48 per week for second six months, $5.60 per week for second year, $7.00 per week for third year, $8.40 per week for fourth year; bonus of $100 at expiration of term if services are satisfactory.

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

How Can I Become a Commercial Engineer?

I remember, some time ago, reading in an account of the "annual staff dinner" held in connection with one of our large electrical manufacturing companies a speech of one of their officials. This gentleman, in describing the onerous nature of his own duties, remarked in a humorous, though, as it struck me (being myself one of the unfortunates *not* on his staff), a rather unfeeling manner, that "a great deal of his time was taken up in interviewing out-of-work engineers who had been discharged from good positions as 'The firm were reducing their staff, &c.'"

As I was then in such a position myself, and was spending many hours daily in writing applications to all the firms I could find, it occurred to me that my chances of success must be small indeed if officials of other companies were kept as busy in that way as this gentleman said he was.

Experience confirmed me in this view—no engineers were wanted by anybody.

As an engineer—and when I say engineer I do not mean an alternating engineer, a shift engineer, or a "greater-including-the-less-engineer," but a continuous engineer, that is, one having continued being an engineer for some time previously—I was evidently not in demand. It seemed to be about time for me to "Get out of the crowd."

I tried to disguise myself as a "Wireman who can do the thinking," but found that "Thinking Wiremen" like "Thinking Parrots" were not in great request.

Then I read in a paper that the need of the times was for "Commercial Engineers."

It was a combination of the man of resistance and horse-powers with the man of insistence and persuasive powers that was really urgently needed if the Empire was to be kept in the front rank of nations and maintain the lead in the engineering of the world. These combination men (if they could be found) might command large salaries, and engineers were exhorted to put aside their prejudice to "touting," &c.

My mind was made up—I would become a Commercial Engineer!

I would secure a good salary in place of a bare living wage; I would cultivate my persuasive powers which I had for so long wasted upon unappreciative employers, and I would assist the Empire in the hour of need!

But how to do it?

I immediately set to work to study commerce. I looked up everything I thought would be useful knowledge to a commercial man, including price lists and railway rates, the law of supply and demand, the Statute of Limitations, and—which I fancied commercials I had known were particularly knowing about—the best brands of whiskey and palm oil.

Had I been a draper or a tripe-dresser and wanted to "Become an Electrical Engineer," I had only to "Investigate this" or "Send a postcard" to learn how I might become almost anything—except a Commercial Engineer.

But postcards were no use for this.

I thought if I were to apply for a position I might learn what were the duties in detail, and ascertain if any of my abilities were likely to be of use.

I did apply—lots!

At last I got so far as to obtain an interview. Then I got to know all about it.

It appears that to be a commercial engineer you must have much experience. Not of engineering—that is quite a secondary matter.

Suppose that you are a commercial attached to a power station.

The power station people let out motors on sale or hire terms and supply power at so much a unit. Your business is to go around to the people who have factories and workshops. You have to convince them that they are simply missing a good thing by not taking out their old gas and steam engines and putting in your company's motors and taking their motive power at so much a unit.

Well, I thought this was all right. By years of experience and systematic record keeping, I was simply bristling with facts and figures, showing that *the* thing for reducing working expenses and increasing output was the intelligent application of electrical power.

If all I had to do was to demonstrate this to prospective customers, my training was all right, and the good salary was in sight. What could be simpler and more congenial to the engineer who really understood and loved his work! When asked if I could get orders, I cheerfully replied that I was sure I could.

Then came the staggerer!

"What experience have you already had in actually booking orders?"

I started out explaining that I had been so busy qualifying for the engineering part that the commercial or booking orders side had not yet received full attention, but I was sure that if orders were to be got I should be able to get them.

But it then appeared that it was the getting of orders which made you a commercial engineer; the engineer part was of very small consequence.

As much as to say that if a man had a good commercial experience in selling tea he might easily become a commercial engineer, but if he were only an engineer he would fail undoubtedly as a commercial.

That which, to me, appeared to be quite an easy matter really required a man of large experience. And that even men of long commercial experience found very great difficulty indeed in persuading people to take out their gas engines and things. Such men—good commercial men—had failed to convert these people, and now they wanted a man still more commercially experienced; they didn't want an engineer.

Now, it appears to me, that that is where they are wrong.

No manufacturer in his senses is going to take a gas engine off his shafting and buy or hire a motor and pay for power that will double the expense of running it. And so whilst possibly the engineer could show him ways of rearranging his plant and increasing his output and saving money, the commercial man, not being so well skilled in these matters has to abandon the job—to his own, the manufacturers, and the power company's loss.

A runs his shop by a gas engine; B is up-to-date and hires a motor from the corporation. Both apparently do the same amount of the same kind of work. A pays 3s. a week for gas, B pays for hire of motor and power 7s. a week (this is a case from my own experience). What would the commercial man do? What he did was to give it up. Yet both A and B now use motors, and neither of them pay 7s. a week now.

However, I was unable to convince the people I interviewed that any potential abilities I might have at command would compensate for my lack of actual experience in booking orders—so I am still unemployed.

So I want to know, if anyone can tell me, how can I get hold of some commercial experience, secure that good salary, and, incidentally, assist the Empire?

What kind of special ability is required, and can it be acquired? Is it like that possessed by the reporter? I read of a certain reporter whose editor sent him to collect the views of an uncertain magnate upon a doubtful subject. The reporter called early in the morning.

The magnate (who was shunt wound and of high resistance) refused to discuss the current topic. The reporter returned to his editor, who said: "This is series, but try him again. If you go and coil yourself on his doorstep and howl like an alternator he may open the door." At last, late in the evening, the reporter got into contact.

But the magnate refused to torque to him, except to remark "What phase! Are you aware that seventeen reporters have tried to see me to-day on this matter, but to all I have given a most + —." The reporter answered "Sir, I am aware—in fact, I am the whole seventeen reporters!"

Would the reporter have made a good commercial engineer? Have I begun at the wrong end? Should I first have apprenticed myself to a tea salesman and picked up a smattering of engineering afterwards? Can I do anything to retrieve my youthful error? In short, can I, and if so "How can I become a commercial engineer?"

I feel sure others beside myself would be glad of information, and possibly some of your readers could help us, so make that my excuse for this intrusion on your

Coulombs.

Telephone Etiquette.

Referring to the letter headed "Telephone Etiquette," which appeared in your last week's issue, the harrowing experience related by "Telephone" is unfortunately a very common one, and the real remedy is to be found by the subscribers involved appreciating the importance of regarding the telephone not as a nuisance or a kind of indispensable evil, but a something which should be looked after with as much care and attention as any other adjunct of their business.

While on this subject I should like to refer to the fact that the average subscriber's operator could very materially reduce the daily friction, much of which, of course, is inevitable, by the exercise of a little more gumption, and if I may say so, suavity. For instance, a very common response when ringing up a subscriber who, perhaps, has anything between 10 and 30 internal extensions concentrated on a switchboard, is, "Hold the line," "Wait a minute," it being a most exceptional thing for any operator to be polite enough to say, "Please hold the line," "Wait a minute, please." It is astonishing what a difference it does make.

I think the matter only requires to be properly ventilated in order to ensure a large measure of rectification.

H. B.

[There is no doubt whatever that a very large proportion of the telephone trouble is due to the slipshod and dilatory methods of the users, as well as their suspicious attitude towards calls. Every care should be taken—at both ends of the line—to ensure promptitude and courtesy in answering a call, and in commencing the conversation. We refer to this matter in our leading columns.—Eds. E.R.]

Political Blackmail.

In your leading note on "The State and its Servants," in the issue of your paper for July 21st, you lay down the law in a manner which is open to severe criticism.

By what ethical, social, or religious standard do you arrive at the conclusion that "electoral pressure on the pocket of the State is highly improper?" Who has the right to distribute State funds if not the electors? Would you rather leave the distribution of those funds to a clique of officials, most of whom already have their own hands more deeply in the pockets of the taxpayer than their meagre services to the community are ever likely to warrant?

If you choose to argue that the Post Office men must not use their votes upon this question, because their own interests are involved; the obvious reply is, that the interests of the rest of the electors are equally involved in the opposite direction, to prevent the Post Office servants from getting too much, and therefore they must not vote either!

It is perfectly clear that the "Servants" (are we not all servants?) of the State have every right to discharge their own managers, if they cannot otherwise secure justice; and no one who has impartially studied the men's case, in this instance, can pretend that they have yet secured just remuneration for their services, or that they are ever likely to secure it from the present Administration.

May I further inquire by what divine right an employer is entitled to for ever exclude those whom he employs from any share in the management of the business in which they are mutually engaged? Is his interest in the concern greater than that of the labourer, who must of necessity live from hand to mouth, and who stands to suffer far more (and there are many more of him!) than the employer, by the closing down of the works?

Those who desire to see industry producing—not dividends—but men and women, can have little patience with the assumption of sole rights of control by those whose distribution of the proceeds of industry proves them to be infinitely more grasping and callous than those who, after meekly bearing the heat and burden of the day, put in a claim for about one-third of what they are worth, and are

expected to take the bare word of their employer (who is, of course, not an interested party!) that the conduct of the business in which they are engaged is no business of theirs.

For shame, Gentlemen of the ELECTRICAL REVIEW! If your columns are not the place for the discussion of social ethics, still less should they accommodate those sleek platitudes by which the truth is concealed from them that are in bondage, and who must remain disinherited until they have the courage and patience to insist on that which is their birthright—a voice in the direction of their own concerns!

T. H. Ferris.

Leeds, *July 24th*, 1905.

[Our correspondent, it would seem, in somewhat flowery if not high-falutin language, arrogates to the employés of the State the right to a share in the control of the national affairs! The direction in which their control would at once be exerted, were they granted such, is perfectly manifest—namely, towards personal profit. Fortunately, the will of the majority still rules in this country, and as the vast majority constitute the *employer* in this case (be it noted that "*there are many more of him*") the greed of the minority will be curbed.

Mr. Ferris is doubtless a telegraphist; we emphatically declare that the duties of the average telegraphist are not of an order demanding a high degree of skill or technical knowledge; they are on a par with those of the typist, and inferior to those of a shorthand writer or a compositor. The fact quoted by Lord Stanley—that there are six candidates for every vacancy in the telegraph service—in itself amply suffices to demonstrate that telegraphists are paid at rates which compare favourably with those ruling in analogous walks of life.—EDS. E.R.]

Some Arithmetical Questions for Mr. Byng.

It is to be hoped that those of your readers who take an interest in the fiscal question will not (in the rush of the holiday season, or in the large number of similar reports of company meetings) refrain from reading Mr. G. Byng's annual address as chairman of the General Electric Co., published at length in your last issue. Whatever their convictions, whether of the settled order or not, their attention may be called to a very remarkable statement of Mr. Byng's. "*The G.E.C. could undertake, if Protection were given their firm, to employ within six months at least 2,000 skilled workmen more than they did that day, and he knew hundreds of manufacturers who could give a similar undertaking.*"

As a critic of certain of Mr. Byng's views, I am quite prepared to leave the "hundreds of manufacturers" to make their own pledges; but before I can accept Mr. Byng's specific pledge, I would like to ask a few questions.

1. Whether he is prepared to accept as correct the items comprising the returns of electrical imports and exports, say, for June last, published on p. 157 of the ELECTRICAL REVIEW?

2. If so, is he aware that after deducting the value of electrical goods re-exported, the net value during June of imports amounted to about £96,000?

3. Is he aware that, taking only purely manufacturing electrical firms with over £100,000 capital, there were (including the General Electric Co.) in the United Kingdom, when the last edition of Mr. Garcke's Manual went to press, no fewer than 30 undertakings with an aggregate capital of £16,538,000? (From these steam engine makers, &c., and foreign firms trading under a British name are excluded.)

4. Assuming that imports of foreign electrical wares ceased, is Mr. Byng aware that a division *pro rata* among the existing manufacturing firms with over £100,000 capital would have meant an increase during June in output of goods valued at £588 per £100,000 of invested capital?

We all know that the world does not work to dead averages, and that superior activities secure the largest plums in the pie. Assuming, therefore, that by reason of the quality of the products and the energy, efficiency and attention to detail which characterise the proceedings of Mr. Byng's firm, the G.E.C. obtained, say, three times its normal share, this sum would amount to £13,265. On this hypothesis I would ask—

5. Where, if the G.E.C. paid each of their additional skilled artisans an average wage of 30s. per week (a total sum of £12,000), the money would come from to pay for raw materials, management expenses and dividends, to say nothing of the deficit of £1,265 on wages alone?

It is tempting to leave my immediate text, and ask further questions on matters in regard to which Mr. Byng's economic faith is based, and without which answers I have no option but to hold the Free Trade view. Respect for your space, and fears of an editorial blue pencil, restrain me. I would like, however, to draw attention to the fact that Mr. Byng, in speaking of the fittings of an hotel in Cannes, suggests inducing the French to reduce duties on these goods. Is this to be done by cheapening champagne or putting a duty on eggs and butter, and then reducing it again as a sort of *quid pro quo* for a reduced tariff on lamps or telephone sets?

Lastly, how very grieved will be the Imperial soul of the author of "Imperial Preferential Policy," which you reviewed so fully. Mr. Byng never mentions Colonial trade or Colonial preferences.

W. Pollard Digby.

London, W.C., *July 29th*, 1905.

Automatism Extraordinary.

I have followed your admirable descriptions of "underground" electrification, but cannot recall any reference by you to the remarkable piece of mechanism alluded to in the enclosed cutting. This apparatus apparently correctly controls the actions of distant signalmen. Details are anxiously awaited.

Arthur Walker.

Lewisham, *August 1st*, 1905.

The paragraph in question reads as follows:—"Automatic brakes are fitted to the electric trains on the underground railway, so that accidents such as happened recently at Liverpool are impossible."

NAME OF MAKER WANTED.—Messrs. A. Reyrolle & Co., Ltd., will be obliged to anyone who will recommend a firm who manufacture stoves for enamelling slates.

LEGAL.

BROWN *v.* CARL OPPERMANN ELECTRIC CARRIAGE CO.

MR. Justice Warrington, in the Chancery Division, on Monday gave the usual debenture-holder's judgement in the action of Brown *v.* the Carl Oppermann Electric Carriage Co., Ltd., and also appointed a receiver and manager.

THE TELEPHONE COMMITTEE'S REPORT.

THE Committee, which has been sitting in London for some weeks past considering the agreement between the Postmaster-General and the National Telephone Co., issued its report on Tuesday. The Committee was appointed to report whether it was desirable in the public interest that the agreement should become binding, with or without modifications, and also whether the interests of the employés of the National Telephone Co. had been duly considered. The proceedings have been reported in the ELECTRICAL REVIEW from week to week. The two main points in the report relate to the treatment of municipalities and of the staff. The report states:—

"On a careful review of the bearing of the agreement as a whole upon the interest of the public, we find that the policy of purchase is to be preferred to the other alternatives; and that if safeguarded as we recommend in the next paragraph it will leave the position of the municipalities unprejudiced as regards the period succeeding the cesser of the company's rights in 1911. We are of opinion that in order to make it clear that municipal licences can be granted between August 31st, 1905, and December 31st, 1911, without giving the National Telephone Co. rights to compensation under the Telegraph Act of 1899 in respect of licences granted after August 31st, 1905, it is desirable that the agreement should be modified by omitting on page 6, paragraph 2 (1) *b*, line 6, the word 'whether' and the words 'or after.'"

This clause will then read as follows:—

(*b*) Any licensed telephonic business of the company which by virtue of the Telegraph Act, 1899, or of any of the agreements in writing between the Postmaster-General and the company particularly specified in the first schedule hereto, or of any other agreement in writing between the Postmaster-General and the company (made before the date of this agreement), can be transacted for any period after December 31st, 1911.

The Committee states:—

"After allowing due weight to the criticisms that have been passed upon details, we think that the agreement provides on balance the best security available in the circumstances that the property purchased shall be good and suitable in quality, and that no more than a reasonable price shall be paid. . . . . While, therefore, we recommend that in the general public interest the House of Commons should not disapprove of the agreement, we think that the agreement, with the modifications that we have proposed, should not be allowed to become operative until a pledge has been given to the House that between now and January, 1912, nothing shall be done by the Government whereby the question of the future ownership and management of local telephone installations (as distinct from the ownership and management of trunk lines) may be prejudiced, and that, unless by a vote of the House it has otherwise been determined, the Post Office shall continue to grant licences to municipalities on terms not more onerous in respect of royalties than the terms of the standard telephone licence as revised in January, 1902."

The Committee's recommendations as to the treatment of the staff read:—

(*a*) All officers and servants who shall have been not less than two years continuously in the service of the company on December 31st, 1911, shall, as from that date, become officers and servants of the Postmaster-General on the terms of hiring and conditions of employment which obtain in the grade to which they are transferred.

(*b*) Such officers and servants as are not beneficiaries of the pension scheme of the National Telephone Co., but who, if in the service of the Postmaster-General, would be on the established list, on entering the service of the Postmaster-General shall, for the purpose of superannuation and of being placed on the established staff, be entitled to count their past years of continuous service with the National Telephone Co., subsequent to 1909, as years passed in the Civil Service of the Crown.

(*c*) The company should be required to submit all candidates for the National Telephone Co.'s service from August 31st, 1905, to the same, if any, medical examination as that required for officers and servants entering the Government service in the same grade. And we recommend that employés of any class now in the service of the company, and in their service on December 31st, 1911, should, if taken over by the Post Office, not be required to submit themselves to medical examination.

The Committee recommend "an undertaking by the Postmaster-General that no servant of the company taken over by the Post Office shall suffer by this transfer whenever it takes place, *i.e.*, that the employés of the company shall have the option of either continuing on the same terms as to pensions which they now enjoy under the company, or adopting the superannuation terms and conditions of the Post Office service. Having regard to what we have recommended, and assuming that those recommendations are carried out, we do not think that the coming into operation of the Agreement will place the staff in any worse position than that in which they stood on February 2nd, 1905."

BUSINESS NOTES.

Exhibition.—The Ironmongery, Hardware, Electrical and Allied Trades Exhibition and Market, held under the auspices of the Ironmongers' Federated Association at the Agricultural Hall, Islington, from the 25th ult. to the 4th inst. was an excellent one as regards the two former trades. The same, however, cannot be said of the electrical industry, but doubtless the approaching Olympia Exhibition is monopolising the attention of the electrical manufacturer.

Messrs. F. A. Glover & Co., Ltd., Vine Street, Clerkenwell Road, E.C., were represented by an attractive stand, on which were displayed electric motors, fans, rheostats, fittings, &c., an electrically driven air deodoriser and also a self-contained polishing motor, the polishers being attached to the armature spindle.

Messrs. Richard Johnson & Nephew, Ltd., 65, London Wall, E.C., and Bradford Iron Works, Manchester, had an excellent exhibit of steel, iron, barb and copper wires of all sizes, and for all purposes, staples, &c. We would draw attention to the fact that Messrs. Johnson & Nephew about 18 months ago erected a modern plant for the drawing and tinning of copper wire. This new plant forms an addition to their Manchester works, and they are now in a position to supply cable-makers, &c., with high conductivity copper wire.

The American Electrical Novelty and Manufacturing Co., Ltd., and The Horsfall Destructor Co., Ltd., were also represented at the exhibition.

Petrol-Driven Dynamo Sets.—The British Empire Motor Trades Alliance has received an inquiry for the names and addresses of British firms who manufacture petrol-driven dynamo sets. British manufacturers who can supply these are requested to communicate with J. B. King, secretary, 11, Red Lion Square.

Electricity and the Chilian Mining Industry.—Reporting on Mines and Mining Operations in Chili, the German Consul-General at Valparaiso remarks that the question of smelting by electricity will in a few years play an important part in the Chilian industry, as there is a rich supply of water-power from the Cordilleras, particularly in the neighbourhood of the iron and other ore deposits. By the construction of dams the water could be made even more serviceable. In the neighbourhood of the iron ore deposits there are several valuable rivers, *e.g.*, in Central Chili, the Maipo, the Mapocho, and the Aconcagua; in the province of Coquimbo the Illapel, the Choapa, the Limari and the Coquimbo, and in Atacama the Huasco. Already a company, the Sociedad de Altos Hornos (smelting furnaces) Electricos, has been founded in Chili by an Italian, José Pedro Alessandri, which will deal with copper as well as iron. The company is seeking to acquire several water properties, especially those of the rivers Teno and Tinquiririca.

Electricity in India.—The *Englishman* (Calcutta) recently published an article on electricity in India, which may be of interest to the electro-technical industry of Great Britain, as showing the present development of the use of electricity and the further possibilities for its introduction. The writer states that electricity was first used in the Madras Presidency for tramway purposes. Bengal has adopted electric light and electrical fans. Calcutta is wealthy, and coal is only Rs. 5 per ton, so that electrical companies are able to pay handsome dividends. Coal and labour are cheaper in Calcutta than at any commercial centre in Great Britain. Travelling north, the price of coal rises mile by mile, and the general flatness of the country renders the idea of utilising the sluggish waters of the rivers quite impracticable. The only place where water-power has been used in Bengal is said to be Darjeeling, where a pioneer installation on a small scale was carried out some few years ago. Water-power has been used in the Southern Presidency at Coonoor to supply power to the Government cordite factory and a further utilisation of the same stream to work the railway from Metapalliam to Ootacamund has been proposed by a large firm of engineers in London. In Bombay there are many small steam-driven installations for light and the working of fans, but for tramway purposes horse power is still used, although this method of traction is likely soon to be changed. Bombay, however, suffers from the absence of cheap coal and adequate water power. Rumours are afloat to the effect that it is proposed to raise capital for the purpose of constructing in the Ghauts, 40 miles from Bombay, some huge reservoirs to hold up sufficient water to produce, all the year round, the power necessary to furnish Bombay with the energy so large a city requires. It is feared, however, that the cost of the reservoirs and dams necessary to effect this purpose would make the power very costly. The chief commercial city of the United Province, viz., Cawnpore, uses roughly in its factories and mills about 7,000 H.P. To produce this small amount of power, and to transmit it from the nearest possible source of hydro-electric generation, would mean locating the works 230 miles away on the Surda River; Cawnpore and Lucknow will, therefore, apparently have to depend on steam-generated electricity for light, fans, and traction in the future as at the present time. The Indian Electric Supply and Traction Co. have undertaken to provide this commercial centre with power. Further north there are great prospects of utilising the power of the waterfalls of the United Provinces and Punjab Canals, and of the rapids of the Himalayan rivers. At Peshawar, the water-power of a canal deriving from the Cabul River is shortly to be used for lighting and fans for that cantonment, to be followed by an extension of the scheme to the city, and, possibly, later on, for traction between it and the cantonments. The prospects of a railway between the Punjab and Kashmir, starting from Hassan Abdal, and entering the Jhelum Valley at Musaffirbad, are being restudied with a view of this line being carried out as an electric railway. Further east in the Jhelum River, works to generate electricity to be used for pumping for agricultural purposes are in hand. At Lahore a concession has been, or will shortly be given, to a syndicate, which, probably in co-operation with another powerful syndicate that proposes to work the water-power of an adjoining canal, will supply electricity at a moderate rate. It is intended also to supply Amritzar with cheap power from the same canal, so that the city's commercial future should be assured in spite of the high price of coal. Delhi is unfortunate in being too far from any fairly permanent source of water power, but this difficulty may be overcome in time. Other cities, such as Saharanpore, which is situate at the junction of four lines of railways, and has the Eastern Jumna flowing through it, may, if commercial magnates rise to the occasion, become towns of great industrial importance.

German Imports and Exports of Electrical Machinery.—So far this year there has been a slight decrease in the exportation of electrical machinery from Germany, the returns for the five months ending with May last showing a total of only 5,466 tons, as compared with 5,640 tons in the corresponding period of last year. On the other hand, the imports of foreign electrical machinery into Germany show a slight increase—from 500 tons in the first five months of 1904 to 534 tons in the months ending with May last.

Uralite.—A fire test was carried out on July 25th by the British Uralite Co., Ltd., at the Garden City, Letchworth. A section of timber partition, protected by Uralite, was subjected to a very fierce heat, and in the middle of the flames a wooden box,

also protected by Uralite, was placed. The partition suffered no injury, and, after the flames had been extinguished, the wooden box was opened in the presence of the spectators and the contents handed round. The contents consisted of paraffin wax, which had not even been melted, pieces of fusible metal, sulphur, and various papers. The spectators expressed great surprise at the wonderful fire resisting and non-conducting properties of the material.

Patriotic Stamps.—Mr. Frederick Hawke, of 2, Queenhithe, Upper Thames Street, E.C., has sent us some specimens of his new Patriotic stamps, which are intended to be placed on the left-hand corner of envelopes or on parcels of goods, urging everyone who reads to "Buy goods of British manufacture." Those who feel inclined to adopt this method of encouraging home trade should communicate with him.

Works Visit.—The members of the Gloucester Engineering Society visited the works of the Lister Electric Manufacturing Co.'s works last week. A new department has been started at the works within the last few months in the manufacture of electrical accessories, under the superintendence of Mr. F. H. Headley. The electrical works are under the direction of Mr. T. L. Boyden.

Plant for Sale.—The Fulham Council is inviting offers for a Musgrave horizontal low-speed engine and G.E.C. alternator. See our advertisement pages for particulars.

Book Notices.—*Key to the Classifications of the Patent Specifications of France, Germany, &c., in the Library of the Patent Office.* London: The Patent Office. 1905. Price 6d.—This is the second edition of volumes No. 1 and 5 of the Patent Office Library Series, revised and materially improved, and is specifically designed to facilitate the process of "searching for novelty." The Patent Office handbooks are models of what such a series should be, and as good wine needs no bush, so these books need no commendation.

"*Die Elektrischen Druckknopfsteuerungen für Aufzüge.*" By A. Genzmer.—This little book belongs to the now numerous class of publications specialising in one particular branch of electrical engineering, and gives a satisfactory and comprehensive survey of the question of push-button control of passenger and goods lifts. This is a subject on which little has hitherto been published in German, and still less in English, although it is quite sufficiently standardised to demand some such treatment as the present book gives it. A general idea of what push-button control involves is first given, and the separate parts of the apparatus are then considered in detail. Of this apparatus great importance is justly attached to the motor starting resistance and switch, and nearly half the book is devoted to a full description of the design of starting and regulating resistances for direct-current and three-phase alternating-current motors, together with their switches, blow-outs, relays and safety devices, more especially, of course, in their relation to push-button control. Then follow descriptions, with diagrams of the various schemes of connections adopted, descriptions of automatic contact-making devices and of auxiliary safety devices. There is also a detailed explanation (with worked example) of a method for designing pot magnets, with conical plunger ends, for use with brakes, relays or automatic switches. The last part of the book contains useful descriptions, well illustrated by photo-reproductions, of standard lift installations as carried out by four leading German makers—the Allgemeine Elektricitäts Gesellschaft, the Siemens-Schuckert Werke, Messrs. H. Findeisen and Messrs. Lahmeyer. No index is provided, and one or two slips occur—as, for instance, on p. 103, where the best angle for the coned end of a magnet-plunger is stated to be 20° to 28°, although 40° to 56° is correctly shown on the accompanying curve; but, as a whole, the book can be thoroughly recommended, and would appear to be well worthy of an English translation.

"*Electrical Instruments and Testing.*" By Norman H. Schneider. New York: Spon and Chamberlain.—The object of this book is to explain how to use the voltmeter, ammeter, galvanometer, potentiometer, ohmmeter, and the Wheatstone Bridge. The phraseology of the work is decidedly loose; in the opening chapter, for example, the writer speaks of the "swing" of the needle of a galvanometer, when he apparently means the steady deflection. He says "the movement of a galvanometer needle from one position to another is termed its deflection:" we were not aware that this was the case! The "Thompson" galvanometer also is spoken of. On page 4 the author very correctly remarks, "it is very common practice to speak of a coil as being wound to a given resistance, when ampere turns are really desired." The author's definition of a "tangent" would hardly be accepted, we think, as being either correct or lucid; he says "a tangent is a straight line perpendicular to the diameter of a circle limited in length by the sides of the angle, one of which is the diameter of the circle." On page 78 we have the following brilliant mathematical example:—"For example, if 1 = 2, what will 4 equal?" On page 137 we are told "its condenser does not store up electricity." As a work descriptive of various classes and makes of apparatus, the book possesses some degree of merit, but to the beginner the book would be of little value, the amount of explanation given being insufficient, whilst to the advanced student it would be almost equally valueless, as it could add but little to knowledge acquired from other works. In fact, the book holds an intermediate position which may make it useful as supplementary to a junior student's primer; the loose way in which it is written to a great extent, however, discounts its value. The author possibly knows what he is writing about, but does not know how to write it.

"Transactions of the International Electrical Congress at St. Louis, 1904." In three volumes. Published under the care of the General Secretary and Treasurer.

"National Physical Laboratory—Collected Researches," Vol. I. Teddington, Middlesex: The Director, N.P.L.

"Science Abstracts," Sections A and B, July 25th, 1905, No. 91. London: E. & F. N. Spon. 1s. 6d. each section.

"Proceedings of the American Institute of Electrical Engineers," Vol. XXIV., No. 7, July, 1905. New York: A.I.E.E., 95, Liberty Street.

"Transactions of the Faraday Society," Vol. I., No. 2, May, 1905. London: The Faraday Society. 10s. 6d.

"Meine erste Influenzmaschine und eine ähnliche Vorlesungsmaschine zur Erläuterung der Theorie." By Prof. W. Holtz. Reprint from the *Zeitschrift für den Physikalischen und Chemischen Unterricht*, for May, 1905. Berlin: Julius Springer.

"Uber die Lichtenbergschen Figuren und ihre Entstehung." By Prof. W. Holtz. Reprint from the *Physikalische Zeitschrift*. Leipzig: S. Hirzel.

"Der negative Büschel mit Stiel und Zweigen in freier Luft." By Prof. W. Holtz. Reprint from the *Annalen der Physik*. Leipzig: J. A. Barth.

"Journal of the Institution of Electrical Engineers," No. 174. Vol. 35, July, 1905. London: E. & F. N. Spon. 5s.

Bankruptcy Proceedings.—The public examination was held last week, before Mr. Registrar Brougham, at the London Bankruptcy Court, of James M. Richardson, described as of Harvey Buildings, Strand, and who applied to pass upon accounts showing total liabilities £6,929 (unsecured £5,429) and assets £26, exclusive of a bad book-debt for £11,000. In the course of his evidence, the debtor said he had invested large sums in various companies since 1884, nearly all of which had been absolutely lost. In 1895 he became interested in the Lithanode Co., which was formed to manufacture material for secondary batteries. He acted as manager of that company, which went into liquidation in 1899. Witness thereupon started a similar business on lithanode lines, and in April, 1900, he promoted Longstreth's, Ltd., to take over his business and the lithanode patents. As vendor he received £250 cash and £500 shares, and he acted as managing director until this receiving order was made, whereupon he resigned. His failure was caused by unprofitable investments, in connection with which he had lost over £30,000. The examination was concluded.

At a sitting of the same Court, held on Tuesday before Mr Registrar Linklater, the public examination was held of H. Thorpe and H. J. Salter, electrical engineers, &c., lately carrying on business in partnership as Thorpe & Salter at 235, High Holborn and Eden Grove, Holloway. The joint statement of affairs shows liabilities £705 13s. 4d., and assets nil. Under examination by Mr. S. J. Grey, Official Receiver, the debtor Thorpe stated that separate receiving orders were made against them last April, but in May the proceedings were consolidated. Witness commenced business in 1877 at High Holborn with £100 capital. In 1894 he was joined in partnership by a Mr. Waring, who introduced £250 capital in return for a one-third share of the business. They traded at 59, Theobald's Road, Bloomsbury, as Thorpe & Waring. That partner retired in 1896, and immediately afterwards witness was joined by Mr. Salter, who put £250 into the business, and took a one-third share. They removed to 17, Red Lion Street, and traded as Thorpe & Salter, also subsequently at High Holborn until April, 1904, when the business was converted into a limited company, registered as the New Century Lock and Engineering Co., with a capital of £500, the idea being to raise money by the issue of debentures. The company took over the assets but not the liabilities. Soon after the conversion witness was pressed by creditors, and, one of the number having obtained a committal order, he was sent to Holloway. His wife paid the debt, and, in order to avoid further committal orders, witness filed his petition. The debtor Salter was also questioned, and the examination of both debtors was then ordered to be concluded.

Consular Notes.—Cadiz.—In his report for 1904, Mr. Consul Keyser mentions that a company has been formed for the purpose of constructing an electric tramway from Cadiz to San Fernando and Carraca, the Government Arsenal. The company is named the Compania del Tramvia Electrico de Cadiz à San Fernando y la Carraca, and those chiefly interested in it are the Spanish Thomson-Houston Co. and Messrs. Carde & Escoriaza, of Zaragoza, who are builders of electric railway carriages. Mr. N. Escoriaza is contractor for the line. The 32 carriages will be built at Zaragoza. Some progress has been made with the 7 miles of line under construction. The power station will be located at San Fernando, and it will contain two dynamos worked by horizontal steam engines of 200 I.H.P. each, supplied from three Cornish boilers. The station site will be arranged to allow of easy addition of further plant for extension of the lines to Chiclana and Algeciras. Messrs. Tosi, of Legnano, are supplying the engines and boilers—indeed, they have supplied such for all Thomson-Houston works in Spain. The electric material has been supplied by the American Thomson-Houston interests. The tramway company will also light San Fernando.

Mr. Keyser also refers to a scheme which has been proposed for a coast railway which has not yet passed the preliminary talk stage because it is too ambitious. The Consul thinks that a light railway constructed at far less cost would equally open up the country and be a remunerative enterprise. At present the coast towns are away from direct communication with the populous centres, where lies a market for all they produce. Consul Keyser says that, while railway promoters continue their discussions, a light line might be laid and opened. The proposed route of the railway scheme is from San Fernando

through Chiclana, Medina, Conil, Vejer and Tarifa. Among other matters touched upon in this report is the question of openings for British trade. It is pointed out that the South of Spain is full of possibilities for almost every branch of commercial expansion. Traders, however, must remember that in order to attract purchasers in a foreign country they must put before them detailed information in the only tongue and currency which they understand.

Central Italy.—Consul Morgan, in his report for 1904, mentions that a firm of Belgian bankers has recently formed a company with the object of building an electric railway between Rome and Civita Castellana, with a capital of £140,000. The present distance between the two places by railway is 50 miles, but the proposed new line, by following a direct track, will shorten the distance by 15 miles. It will pass through fertile grounds covered with olives, vines and forests. The carriages have already been manufactured by Messrs. Tabanelli, of Rome. The electric plant will be laid down by the Rome Agency of the Westinghouse Co. The rails and other fixtures will be supplied by the Savona Works. The power house plant will consist of steam turbines driving single-phase current machines. There will be a service of trains every two hours. The line may be extended later further inland, to Viterbo. Full particulars of the scheme were recently published in the Electrical Review.

A New Zealand Exhibition.—It has been resolved by the Government of New Zealand to open an international exhibition at Hagley Park, Christchurch, Canterbury, New Zealand, in November, 1906, continuing until early in April, 1907. A copy of the preliminary prospectus, with rules and regulations for exhibitors, has reached us. From these we gather that the object of the exhibition is educational, its intention being to demonstrate the resources and possibilities of the colony, and to bring under the notice of the more industrial nations of the world the great field that it offers as an outlet for enterprise, and for the use and consumption of all manner of up-to-date appliances, manufactures, &c. The sparsity of population is said to provide an exceptional market for all labour-saving machinery in the various departments of life, and manufacturers are urged to appoint representatives, and to send such exhibits as will show the nature and finish of their work, and be suitable for this very progressive colony. Electricity will be prominently in evidence for illuminating purposes, and there will be a supply available for exhibitors wishing to display machinery in motion. There may be a temptation, as the exhibition authorities have issued their prospectus in such good time, for British firms at home to put off the consideration of the matter. We would urge them not to give way to the temptation, but to weigh seriously and immediately whether it will not be worth their while to strengthen whatever hold they may have upon the New Zealand electrical and machinery market by taking part in this exhibition. To that end they should at once ask for copies of the prospectus. Mr. E. J. Righton is the secretary, and the principal office is at Christchurch, Canterbury, New Zealand. The Exhibition, it might be added, is under the patronage of the Governor, and the Premier, Mr. R. J. Seddon, is president.

All applications for prospectuses should be addressed to the High Commissioner for New Zealand, 13, Victoria Street, Westminster, S.W.

French Interest in Belgian Works.—The report for 1904 of the Société Parisienne pour l'Industrie des Chemins de Fer et des Tramways Electriques, which has a share capital of £2,000,000, states that at the end of that year the company concluded an agreement with the Société des Ateliers de Constructions Electriques, of Charleroi, whereby it took over the working of the Jeumont workshops, formerly the works of the Société d'Electricité et Hydraulique. By this means the Paris company is able to undertake the construction and equipment of central stations, the transmission of power, and electric tramway and railway works. The company has received orders from the Metropolitan Railway Co., of Paris, and from the Lille tramways, the Paris tramways, and other French lines, the Ostend tramways, the Bradford tramways, and the London Metropolitan Railway. A large interest has been taken in the Société d'Electricité de Paris, and investments are also held in various tramways in different countries. The accounts of the company show a profit balance of £57,133 for 1904, and after placing 5 per cent. to the legal reserve fund a dividend has been declared at the rate of 4 per cent. on the paid-up capital.

Annual Outing.—On Saturday, July 22nd, the employés of Messrs. Marryat & Place went for their annual outing. Starting from Kingston by launch, they steamed up river as far as Staines, lunch being served on board. The return journey was commenced at 5 p.m., a halt being called at Chertsey for dinner, after which a concert was held, Mr. Marryat being in the chair.

Catalogues and Lists.—East Anglian Engineering Co., Ltd., Stowmarket.—Latest price list of "Bull" continuous current motors, shunt or series-wound. A lengthy list is given of places where these motors have been adopted for driving organ-blowing machinery.

Messrs. W. H. Palfreyman & Co., 17, Goree Piazzas, Liverpool.—Pamplet entitled "Case Hardening: What to Use—How to Do It," discussing the firm's hydro-carbonated bone-black for case-hardening.

Messrs. Geipel & Lange, Westminster.—Illustrated lists of Vulcan portable galvanometers (polarised type) and hot-wire ammeters and voltmeters.

General Electric Co., Ltd., London, E.C.—A small novelty card in the form of one of their K25 battery wall telephones. This instrument, we understand, has recently been remodelled to ensure greater simplicity and efficiency. By opening the card, one is able to see the connections inside the instrument. It is a happy idea in advertising ingenuity.

Messrs. W. N. Brunton & Son, Musselburgh.—Several new catalogues relating to wire-ropes. The lists are very handy in size and form and neatly produced. Every effort has been made in the arrangement of the particulars to enable customers to find what they require easily and quickly. The firm have put into their works the latest and most up-to-date machines, and they are manufacturing wire ropes from start to finish, drawing their own wire and spinning their own ropes. We understand that there is not another firm in Scotland that is doing this. The lists before us are entitled respectively:—Hoisting wire ropes; marine and shipping wire ropes; and round wire ropes for mines and collieries. Copies will be forwarded by the firm to anyone interested in the use or application of such ropes.

Union Electric Co., Ltd., London.—The company is about to issue a new list of low tension switchgear, describing two leading types of switches, viz., Pattern B, small ampere capacity, and made one, two, or three-pole; Pattern C, for larger currents up to 6,000 amperes. The latter pattern has a magnetic blow-out and also spark-carrying contacts. Both types are arranged for mounting behind the switchboard with the operating handle in front. For use in connection with these switches special open fusible cut-outs for low voltage and enclosed handle plug carriers for high voltages are also included in the list.

Dividends.—Notice is given in the *London Gazette* of a second and final dividend of 1s. 3½d. in the £ in *re* Albert Smith (Electric Motor Supply Co.; West Bridgford and Nottingham). Payable from August 21st at 4, Castle Place, Park Street, Nottingham.

A first and final dividend is to be shortly declared in *re* the Electrical Fittings Co., Ltd. Debts have to be proved by August 15th. J. D. Pattullo, 65, London Wall, E.C., liquidator.

Notice of a second and final dividend of 1s. 4d. in the £ is given in the case of Chas. A. Smith, electrician, of King Street, Regent Street, W. Payable after August 14th at the offices of R. J. Ward, 2, Clements Inn, Strand.

August 14th is the last day for receipt of proofs for intended dividend in *re* Peter Pilkington, Ltd. (liquidator, Mr. James Todd, 3, Winckley Square, Preston, Lancashire).

Electric Coal-Cutters.—The Brush Electrical Engineering Co. has secured a contract from the Cadzow Coal Co. for one Birtley-Falcon electric coal-cutter.

Dissolutions and Liquidations.—The Improved Electric Glow Lamp Co., Ltd., on July 25th resolved to wind up voluntarily, with Mr. S. Wiltshire, 19, St. Dunstan's Hill, E.C., as liquidator.

Messrs. J. Carter & J. Horsfall (Carter & Horsfall, electrical engineers, Manchester Road, Nelson, and motor and mechanical engineers, Holly Bank, Brierfield) have dissolved partnership. Mr. Carter will continue the Nelson business and attend to debts. The Brierfield business will be continued by Mr. Horsfall.

Trade Announcements.—A limited company has been formed in Italy known as the C.G.S. Societa Anonima per Instrumenti Elettrica gia C. Olivetti & Co., for the manufacture of electrical measuring instruments. It is a combination of the well-known business of C. Olivetti & Co., of Milan, with the measuring instrument section of the Tecnomasio Italiano Brown-Boveri.

Messrs. W. H. Isherwood & Co., electrical and mechanical engineers, Carlton Mills, Leeds, have appointed Messrs. James Gray and Co., 212, St. Vincent Street, Glasgow, as agents for Scotland for their mining switches and other goods.

We are informed that the agency for Great Britain and Ireland for part of the manufactures of the Mulheim Works (Carlswerk) of Messrs. Felten & Guilleaume-Lahmeyerwerke, viz., all insulated wires and cables for electric light and power purposes and for the Neptune copper rail bonds, will, from August 1st, be transferred to the Lahmeyer Electrical Co., Ltd., 109-111, New Oxford Street, W.C., and that their English chief electrical engineer, Mr. R. R. Todd, will join the Lahmeyer Electrical Co., Ltd., from that date, as manager of their cable department. The agency for telephone and telegraph wires and cables as well as for all bare iron, steel, copper and bronze wires for all purposes, and their numerous other wire manufactures, such as wire rope, wire netting, barb wire, wire chains, wire mats, &c., will remain with Messrs. W. F. Dennis & Co., 49, Queen Victoria Street, E.C., as before.

LIGHTING AND POWER NOTES.

Beckenham.—The U.D.C. has approved the signing of an agreement with the Administrative County of London and District Electric Power Co. It will be remembered that this Council decided a short time ago to take over the electric light undertaking from the B.I. & H. Cables, Ltd., on the expiration of the lease in November next, and the present agreement with the Electric Power Co. will effectually prevent the further development of this undertaking, if carried into effect. The agreement provides for the

laying of all cables in a manner approved by the Council, and for the company to pay all costs for the laying of lines, removal or alteration at any time, if required by the Beckenham authority. All differences between the authorities must be settled by arbitration, and the reasonable costs paid by the company. Within 12 months of the passing of the Act, the Council may require the company to supply all the energy which the Council may require, on terms to be settled by arbitration, but the company must make it more advantageous for the Council to take such energy than to extend its plant. If the Council takes a supply for the surplus lighting load only beyond what its station can produce, the charge is to be 1·25d. per unit; if it takes the whole of the supply for the tramways (at Penge) the price will be 1·1d. per unit; but if it takes the whole of the supply it will be charged at the rate of ·95d. per unit. The company will have to purchase all plant which may be put in by the Council to supply energy which the company are not in the position to supply after the required notice has been given. The Council on its side must not increase the capacity of the plant in its generating station beyond the amount required to meet the demand for energy for a period of three years from the passing of the Act, but shall purchase from the company any additional supply required. The supply shall be given by the company for a period of 50 years, but the agreement may be determined at the end of 25 years on proper notice being given. At the expiration of every period of five years from commencement of supply from the company, the Council shall be entitled to appeal to arbitration for a reduction of the price charged. The whole of these conditions are also to apply to the Bromley (Kent) B.C. in the event of the Corporation purchasing the undertakings of the Bromley Electric Light and Power Co.

Bexley Heath.—A resolution put forward at a ratepayers' meeting held on Saturday last, protesting against the action of the U.D.C. in arranging terms with the promoters of the Administrative County of London Power Bill without taking the ratepayers into its confidence, was carried unanimously.

Canada.—Ottawa.—The City Council and the Consumers' Co. have reached an agreement by which the city pays the latter the sum of $200,000 for its plant, the company, however, to hand over to the city only $3,000 worth of the $10,000 stock on hand, this making the price equivalent to $207,000.

Continental Notes.—Germany. — Tenders for the establishment of an electricity works in the town of Celle, at an estimated cost of £15,000, are to be invited.

Belgium.—The municipal authorities of Erquelinnes are inviting offers for the establishment of on electric lighting station in the town.

Italy.—La Società Lombarda per Distribuzione di Energia Elettrica has secured a concession to erect a hydro-electric plant on the River Ticino at Turbigo.

A company has just been formed at Brescia with a capital of £80,000, and with the title La Società Elettrica Bresciana, to undertake the electric lighting of the town.

Cotton Mills.—The sixth story of the Acme Spinning Mill, Pendlebury, is to be operated by electricity throughout, and for this purpose the Lancashire Electric Power Co. is about to install the necessary machinery.

Coventry.—The electricity department of the Corporation last week opened the electricity works to the inspection of the public, with a view to popularising the electric light.

Croydon.—On the subject of street lighting, and mainly affecting the question of electricity *v.* gas, an exhaustive report has been submitted to the Council by the Lighting and Electricity Committee. The report states that with the exception of one district in London, where high pressure gas is being used, no town appears to be reverting to gas, and in this case gas has not superseded electric lighting by arc lamps. On the other hand, the Committee finds that lighting by electricity is considerably on the increase, and several towns have now no gas lighting in the streets. In regard to the action of the City of London Corporation in deciding to experimentally light three streets with gas, the Croydon Committee points out that there has not been any attempt to compare the proposed gas lighting with the more modern systems of electric lighting. There are now two electric supply companies competing in the City of London, but neither company was asked to submit a formal tender for comparison as to the cost of street lighting, and under the circumstances, and apart from the fact that the present installation is an experimental one, it does not consider that any importance whatever can be attached to the action of the City Corporation. The Committee, in deciding for a continuance of electric lighting, remarked that each year's working showed a gradual reduction in the average cost, and from September 29th next £1 per annum per lamp for arc lighting will be taken off.

Dover.—The B. of T. has granted the Corporation's application for an order extending the E.L. area so as to include the Parishes of River, Ewell, Whitfield, St. Margaret's at Cliffe, West Cliffe, Guston and part of Alkham.

Dundee.—The burgh electrical engineer has prepared a report on the supply of energy to shipyards. He finds that a supply to this industry has a low maximum demand with a large consumption, and that prices charged for such supply vary from ·85d. to 1·2d. per unit. Messrs. Gourlay Bros. & Co. have asked the Corporation if it will give a supply of energy to the whole of their shipyard at 1d. per unit as an experiment for one year. Mr. Richardson recommends the Corporation to agree to this.

Durham County.—A lengthy report on the projected county electricity supply scheme was presented at a meeting of the County Council on July 26th. The Committee reported that just about one-fifth of the area of the county was covered by private companies operating under Acts of Parliament. The Committee appointed to inquire into the matter asked the Council to pass by an absolute majority a resolution to the effect that a Bill should be promoted in Parliament having for its object the establishment of a system of electrical services for the county, and that the expenses of such promotion be payable out of the county fund as general expenses. The Committee also advised that an expert report should be made on the scheme. The subject has been again adjourned until the next meeting of the C.C., when more information is to be laid before it.

Eastbourne.—Mr. J. K. Brydges, the borough electrical engineer, has just presented his annual report on the past year's working, and from this we gather that the net profit is £3,858, as against £2,726 in the previous year. Out of this sum £1,000 has been set aside to depreciation, and £750 allocated to the relief of the rates. The number of units sold amounted to 753,562 for private lighting, and 24,428 for power, against 714,716 and 18,686 respectively during the corresponding 12 months.

Faversham.—The accounts of the Corporation E.L. undertaking from June 9th, 1904, to March 31st, 1905, show a gross profit of £240, and a deficit to be met out of the rates of £544.

Godalming.—The Urban Electric Supply Co., having laid mains, and supplied energy outside the area prescribed by the prov. order, the T.C. has advised the company to apply for an extension of the order so as to take in that part of the outside area being supplied, and such additional area as is thought necessary.

An electrical exhibition was held last week under the auspices of the Supply Co.

Haydock.—The Wigan T.C. has informed the U.D.C. that it cannot, for the present, consider the giving of a supply of energy to any township outside its district.

Hull.—The E.L. Committee has decided on the substitution for the old H.T. switchboard of a new Ferranti board of similar size, at an estimated cost of £6,400, which, together with building extensions, amounts to £6,800. The engineer is to prepare plans, and Messrs. Ferranti are to submit a tender for the supply and erection of the first half of the above switchgear. Messrs. Earle's Shipbuilding Co. have entered into an agreement with the Council for a supply of energy for a further period of three years.

Lancaster.—The T.C. has reduced the price of energy for private lighting from 5d. to 4½d. per unit.

Leeds.—The City Council has decided to provide arc lamps on all the tramway routes for a distance of 1 mile from the Town Hall. Where it is considered inadvisable to take the supply from the tramways plant, special mains are to be laid down.

London.—City.—The City of London Electric Lighting Co. have written to the Corporation in reference to the notice given them to remove their electric lamps in certain of the main thoroughfares of the City. They point out that under the contracts for electric lighting large expenditure has been made obligatory; in all the company have expended in respect of the public lighting £128,997. To comply with the present request to remove the electric lamps in Fleet Street, Queen Victoria Street, Monument Street and part of Lower Thames Street would mean the destruction of part of the capital outlay of the company on the contracts to the extent of £1,220 per annum. The company point out that they had no choice in the selection of the lamps, standards or glass, which were settled by the Corporation as far back as 1891. The company add that they are not to blame for the antiquated system of lighting now in force, as they have been precluded from incurring any further large expenditure, owing to the uncertainty of their position, two of their three contracts having been annulled some time ago, and the validity of the third questioned, and they state that if the Streets Committee had allowed them to co-operate in improving the lighting of the streets they would, in all probability, have been enabled to submit better terms than the gas company. The company consider that they have a just claim on the Corporation that it should not destroy their capital as proposed, and suggest that a special committee should be deputed to confer with them with a view to the matter being settled in a manner satisfactory to both parties. The letter has been referred to the Streets Committee.

Kensington.—The B.C. has informed the Kensington and Knightsbridge Electric Lighting Co. that it is not prepared, at present, to adopt the company's suggestion with regard to the lighting of the side streets by Nernst lamps.

Battersea.—The scheme for the lighting of Nine Elms Ward by electricity, at an estimated cost of £15,140, has been approved by the B.C.

Stepney.—The B.C. is to tender for the supply of energy in bulk to the Bethnal Green B.C.

St. Pancras.—The gross income of the electricity undertaking during the past year amounted to £68,459—a decrease of £7,652 compared with the previous year. The decrease is attributed to reductions in the charges for energy. There is a net profit on the year's working of £13,099. Of this it is proposed to devote £3,000 to the relief of the rates, £10,000 being added to the electricity reserve fund.

Poplar.—The B.C. has resolved to install additional feeders at a cost of £2,636.

Hammersmith.—Arising out of the recent difficulty respecting the electric wiring contract at the Workhouse, the B.G. on July 26th received a letter from Mr. T. Scott Anderson, electrical engineer, of Sheffield, whose tender was originally accepted, but not sealed, but was subsequently rejected because the L.G.B. declined to sanction the expenditure. Mr. Anderson in his letter claimed out-of-pocket expenses, &c., incurred through making preparations for carrying out the contract, and threatened legal proceedings if his claim were not met. The clerk advised the Board that it could do nothing in the matter, as Mr. Anderson had never been officially informed that his tender had been accepted. It was decided simply to acknowledge the letter.

The T.C. has decided to appeal against the assessment of the electricity works, which has been increased from £3,970 gross to also £14,990, and £3,309 rateable to £9,500, the new figures being deemed excessive.

The T.C. has also decided to expend £50 in the purchase of tickets for the Electrical Exhibition at Olympia, for distribution amongst consumers.

Lambeth.—An application has been received by the B.C. from Mr. A. Cramb, the Croydon borough electrical engineer, stating that an arrangement has been entered into between his Council and the South London Electric Supply Corporation, whereby the former shall lay a main to Central Hill for supplying energy for lighting, and asking for the permission of the B.C. to the laying of the service. The Council points out, however, that it has no power to give the desired consent, as the Supply Corporation can arrange only for the supply of energy within the area covered by its prov. order.

Loughborough.—About the Market Place four new lamp columns have been erected by the Electricity Department to carry Excello arcs of 1,900 c.p. each and 25-c.p. Tantalum lamps, two of the latter to each column. The total illuminating power of the gas lamps which these displace was 640 c.p.

Rochdale.—The accounts of the Corporation electricity undertaking for 1904-5 show a very satisfactory year's working. Below we give the figures in comparison with those of 1903-4 :—

	1904-5.	1903-4.
Total revenue	£9,797	£7,540
Total working cost	4,975	3,847
Interest	1,835	1,372
Sinking fund, &c.	1,792	1,698
Balance	+ 1,195	+ 623
Number of consumers connected	223	172
Equivalent 8-c.p. lamps	28,852	26,432
Units sold (lighting, power and traction) ..	1,160,593	840,530
Maximum load for lighting	391 kw.	319 kw.
Maximum load for traction	517 kw.	250 kw.
Average price obtained per unit	1·98d	2·07d.
Total working cost per unit	1·02d.	1·09d.
Capital expended	£66,414	£53,768

From the above surplus of £1,195 obtained during the past twelve months' working, £1,000 has been set aside to the relief of the rates, and £195 is to be carried to "reserve or depreciation." The increase in the maximum load has been in almost direct proportion to the number of consumers, but the units sold have considerably increased per 8-c.p. lamp connected. The main engine-room building has been practically doubled in length, and three out of five new steam sets, for which space has been provided, have been installed, together with a new motor alternator. New condensers have also been erected.

South Shields.—The Electrical Committee has recommended the T.C. to adopt the following tariff for energy for power and heating in lieu of the present charge of 2d. per unit :—Where the consumption does not exceed 150 units per quarter per horse-power installed, 1½d. per unit ; over 150 and less than 300, 1¼d. per unit ; over 300 units, 1d. per unit.

South Africa.— Krugersdorp.— The Council has recently been advertising the position of consulting electrical engineer to carry out the electric lighting of the town.

Durban.—It is stated that the Government has practically decided upon the centralisation of the electrical distribution at the railway power station, Durban. This scheme will embrace the supply of lighting and power for the railway station, Harbour and Bluff, including when erected the working of the coaling apparatus there.

Pretoria.—Speaking at the Master Builders' Association, the Mayor said that in regard to the E.L. scheme, the T.C. was putting by £660 a month for depreciation, and after paying all expenses, was making a profit of £11,000 per annum. The Council expected to reduce the lighting rate by 25 per cent. shortly.

Johannesburg.—The Robinson Deep Gold Mining Co.'s balance-sheet for 12 months' working contains the following item under "Expenditure" :—Electric power plant, £25,228.

Kimberley.—The general manager of the De Beers Consolidated Mines, Ltd., stated to the T.C. that the present conditions with respect to the electric light could not be remedied until a sub-station had been installed at Beaconsfield.

Torquay.—The engineer of the Dolter Electric Traction Co., Mr. E. A. Mitchell, and the manager, Mr. H. Lancaster, have visited Torquay in response to the invitation of the T.C. at the instigation of the L.G.B., who suggested a conference on the supply of energy for the tramways, and the opinion of the Board that there is ample lighting plant has been confirmed. The company's engineer now suggests that the present station should be enlarged, and additional plant laid down, at an estimated cost of about £7,000.

Tottenham.—The U.D.C., after a long debate, by 14 votes to 10, has ratified the agreement with the North Metropolitan Electric Power Supply Co.

Walthamstow.—The U.D.C. has asked Mr. J. Enright to name his fee to report on the proposed electric supply to Woodford. During the next six months the price to be charged for public lamps, other than arcs, has been fixed at 2d. per unit. The L.G.B. has sanctioned a loan of £8,000 for generating plant.

Warrington.—The Electricity Committee has recommended the T.C. to apply to the L.G.B. for a loan of £3,000 for cable extensions.

Wolverhampton.—The annual report and balance-sheet of the Corporation electricity undertaking has just been issued, and shows on the year's working a gross profit of £12,996; interest amounts to £4,201, and for sinking fund and repayment of loans a sum of £5,341 has been set aside, leaving a profit balance of £3,451. Substantial reductions have been made during the past year on the prices of energy, the actual diminution in revenue on this account being about £3,700. The total working costs were less than during the preceding 12 months, although the output increased 33 per cent. A new Belliss-E.C.C. set has been installed to cope with the tramway load, which also necessitated various other extensions. The total number of units sold during 1904-5 was 2,628,475, 1,281,626 being for traction purposes. The number of 32-watt lamps connected was 72,209, and the maximum load attained was £1,460 kw.

TRAMWAY AND RAILWAY NOTES.

Beckenham.—Under an agreement with the U.D.C. the B.E.T. Co. has undertaken to pay £4,000 by 10 annual instalments, with interest, towards the cost of the Tramways Bill (£4,358), and to take all the power needed for the tramways constructed from Beckenham, with a minimum consumption of 240,000 units per annum.

Belfast.—In the Parliamentary papers of Tuesday, Mr. Joseph Devlin called the attention of the Chief Secretary to the Lord-Lieutenant of Ireland to the dissatisfaction which existed amongst the ratepayers of Belfast at the refusal of the Corporation to introduce ½d. fares in connection with the new Corporation tramway scheme, and asked whether, in view of the pledges on the subject given to the House of Commons during the passage of the recent Corporation Bill, he proposed to make representations to the Corporation on the subject.—Mr. Long, in reply, said he had no information on the subject. The Local Government Board had no functions in the matter, and he did not propose to make any representations to the Corporation.

The reconstruction of the tramway scheme is drawing to a close, so far as the relaying of the line is concerned. The suburban lines are almost complete, and very shortly the lines will be re-laid in the centre of the city. The entire permanent way will be open in September, though electric traction will not be in full operation for a considerable time to come.

Birkenhead.—The report of the working of Birkenhead electric tramways for the past year has just been issued by the general manager, Mr. W. Wyld. The total income amounted to £55,025, against £56,073 last year. The number of passengers carried on all routes was 11,145,531. Of the income, operating expenses absorbed £32,932, against £34,747 last year, leaving a gross surplus of £22,093, against £21,325 last year. The interest and sinking fund amounted to £20,199, against £19,442, leaving a net profit of £1,893, against £1,883 last year. Owing to an alteration in the form of keeping the accounts, an amount of £250 of bank interest, which under last year's system would have been included as net profit, has not been included this year. Had this been done, the net profit this year would have been £260 over last year. The decrease in the revenue is attributed almost entirely to the bad condition of trade in the district, the Docks route, which is a workman's route, showing a decrease of £926.

Brighton.—The new system of tourist cars, inaugurated by the tramways engineer, Mr. W. Marsh, has attained a high degree of popularity. Morning and afternoon "tourist cars" leave the Aquarium terminus for a circular trip to the points of interest about Brighton. The whole trip covers about nine miles, and occupies nearly two hours. The tourist cars carry "personal conductors," who are acquainted with all the points of interest, and indicate and describe them throughout the journey. The cars are always crowded ; three are now running, and more will shortly be required. The fare is 1s., and, of course, passengers will not travel inside.

Canada.—According to the *Montreal Witness*, the Canadian Pacific Railway is considering the advisability of utilising electricity instead of steam in the operation of its trains on the Boundary system in British Columbia. Extensive preparations are being made in that province by a company for the transmission of power along the Kootenay river, for the operation of mines and smelters in the Boundary system. The C.P.R. will possibly make a test of electricity for haulage power on an extensive scale for heavy grades on Rossland Hill, and other neighbouring points, and if satisfactory results are obtained the entire Boundary Line of the company will be operated by electric power.

Continental Notes.—Germany.—The Prussian Minister of Public Works has refused to sanction the Berlin municipal plans put forward for the construction of a surface tramway from the Spittelmarkt to the Hausvoigtei Platz, and thence through Mohren Strasse *viâ* the Wilhelms Platz and the Voss Strasse to the Koniggratzer Strasse. The grounds for the refusal, and in particular in regard to the Mohren and Voss Strasse, are that the time has at length arrived when the main arteries of traffic should not be further burdened with surface lines, but that high-speed underground lines should be constructed instead. The Reichs Gericht has dismissed the appeal of the Grand Berlin Tramway Co. in regard to the action brought against it by the Berlin Municipal Council. The latter has granted permission for the further extension of the underground electric railway from the Potsdamer Platz to the Spittelmarkt. By virtue of agreements between the tramway company and the Council, the former claimed to possess the right to construct the railway or to receive compensation in the event of the concession being granted to anyone else. The Municipal Council brought an action to have the point settled, and with the rejection of the company's appeal by the Reichs Gericht, the Council has won the case and the company is declared to have no such right and is not entitled to an indemnity under the agreements.

The German postal authorities at Cologne have lately put in service a 20-seated electric motor vehicle for the rapid conveyance of postmen between the general and suburban post offices. The car is built on the Krieger system, the four-pole motors being suspended at the forward end of the frame and driving the front road wheels through spur gearing. There are two motors, one for each wheel; they are rated at 3½ H.P. each, but can stand, for a short period, a considerable overload. The electrical energy is furnished by a battery of Hagen accumulators of 192 ampere-hours capacity; it is carried under the body of the vehicle in three sections. The controller is adapted to give eight forward speeds, neutral and braking position and one reverse motion. The vehicle, which was built by the Allgemeine Betriebsgesellschaft für Motorfahrzeuge, of Cologne, is intended for a maximum speed of 11½ miles an hour; it weighs complete 52 cwt., of which the battery is responsible for 17½ cwt.

The intense heat which recently prevailed in Berlin caused interruptions in the tramway traffic. One instance occurred in connection with a section of the short conduit tramway in operation in the German capital. It appears that, in consequence of the expansion of the conductor rails in the Koniggratzer Strasse (corner of Lenné Strasse), the support of an insulator of the rails became broken off, causing damage to the plough of a motor-car belonging to Line 7. A complete stoppage of the cars proceeding *viâ* the Reichtags Platz in the direction of Moabit or Karls Strasse was also brought about by the heat causing an expansion of the rails, whereby the width of the slot was reduced. This incident stopped the traffic on this section for several hours, until the continued application of cold water restored the rails to their original condition.

Switzerland.—At the recent meeting of the Swiss National Council at Berne, a question was raised as to the position of affairs in regard to the introduction of electric traction on the Simplon Railway. In reply, the principal of the railway department stated that the subject had been under investigation for a long time past. The department had entered into an agreement with the Maschinen Fabrik Oerlikon, which was conducting investigations and experimental runs. The results hitherto had not been satisfactory. A technical commission, upon which the State Railway department was represented, was continuing the inquiry, and one of the members was to proceed to the United States for the purpose. The Italian Government had informed the Federal Council that there had been successfully introduced on the Valtellina Railway a locomotive which was able to haul heavy loads at the necessary speed, and that in this way the question of electrical working had been solved. The investigation was being continued by the Italian Government, and the Federal Council had been invited to make an inspection of the railway.

The traffic receipts of the Geneva Tramways Co., Ltd., for the month of June last amounted to 191,840 fr., showing an increase on 1904 of 5,438 fr.

Austria.—The municipal authorities of Gorz are about to invite tenders for the construction of an electric tramway in the town.

Jungfrau Railway.—The section Eigerwand to Eismeer, 10,362 ft. above sea level, was opened to traffic on July 25th.

Croydon.—An important extension of the Croydon tramway system towards London is in progress. The line at South Norwood is to be carried on through Anerley to the entrances of the Crystal Palace at the Low Level Crystal Palace Station and at Penge. A further extension to Mitcham is about to be commenced.

East London Railway.—Lord Claud Hamilton, addressing this company as chairman for the first time, on 25th ult., said the Metropolitan District Railway Co. would withdraw their trains from the East London line on the 31st inst., and the Brighton Co. would take up the working in their stead, but that would entail a change of carriages by the passengers at Whitechapel Station. The Metropolitan Co. had given notice that they would discontinue running trains over the line at some future period. So far no day had been fixed, but it would probably be at no distant date, and in this case the South-Eastern and Chatham Companies would "take up the running" in the place of the Metropolitan Co., but here, again, the passengers would have to change at Whitechapel Station. He did not think that this was a matter about which they need alarm themselves. In time their line would have to be "electrified," but he was glad that they had not been in any undue hurry to take action with that object. Their late chairman (the Hon. A. E. Gathorne-Hardy) told them, in a recent speech, that "he was by no means sure that the live third rail was the best, the safest, or the least expensive mode of working an electric railway." He thought that they need not regret that this matter of the "electrification" of their line had been postponed until they had had the opportunity of judging, by actual experience, whether the Metropolitan and the District Companies had really adopted the right mode of electric traction. When the line was "electrified" it was more than likely that the Metropolitan and the District Companies would resume their service of trains over it. The change of carriages at Whitechapel would be prejudicial, but he did not see how the difficulty was to be got over at present.

Edinburgh.—Although the Edinburgh and Queensferry Tramways Bill was swept aside, there is no doubt that the Edinburgh, Dalkeith and Bonnyrigg line will be in the hands of the workmen before very long. A much stronger case was made out for the Bonnyrigg route at the official inquiry last week. It is not, like Queensferry, dependent upon a summer traffic, and there are more villages and towns to tap, each with industries and important business concerns. Goods are to be carried by the Dalkeith cars, and this is a new departure for Scotland, with the exception of the Wemyss line in Fife now under construction.

Great Eastern Railway.—Lord Claud Hamilton, at the half-yearly meeting on July 28th, referring to the falling-off in suburban traffic, said that the decrease was partly due to bad trade, but it was attributable more to the competition of electric tramways, the Great Northern and City Tube Railway, the creation of additional facilities in other parts of London, and the opening-up of suburban districts on other lines. In face of this, they were threatened with a new tube line into their district, passing through Leyton and Walthamstow to Waltham Abbey. The Committee of Parliament, in passing the Bill in question, had inserted a clause compelling them not to charge higher fares than the Great Eastern, and therefore it was evident that this projected line, if constructed, could not pay, although it would undoubtedly do them a great deal of harm by its unnecessary competition. Their motor-omnibus experiments had been so successful that they were constructing 12 or 14 more.

Great Northern and City Railway.—Mr. James Green, F.S.I., has lately been holding an inquiry into the claim of a freeholder of 21, Highbury Crescent, N., who alleges that damage done to the house by the tunnelling operations of the railway company has reduced the rental value by £50 a year. The evidence given by engineers and surveyors showed that there had been a serious settlement of the foundations, and that some of the rooms had become unsafe for occupation. Last year £1,200 was spent on the reinstatement of the house.

Hythe (Kent).—The T.C. has received from the National Electric Construction Co., Ltd., an offer to construct tramways in the borough in conjunction with a scheme from Folkestone on the Dolter surface contact system. The offer is either to work the tramway on behalf of the Council, or to carry it out under ordinary contract.

Lancaster.—The past year's working of the tramway undertaking shows a loss of £3,180, against a deficit in the previous year of £2,833.

Leith.—A satisfactory trial of part of the new electric tramway in Leith has been made. The B. of T. inspection was to be held this week on the Pilrig and Newhaven section. It will be some time before the other sections are so well advanced.

Liverpool-Southport Electric Railway.—On the evening of the 27th ult. an appalling disaster took place on the Southport-Liverpool Electric Railway (L. & Y.), by which 20 persons were killed. The disaster occurred to the 6.30 p.m. express electric train out of Liverpool. The train passed Blundell Sands, and Hall Road station was being entered, when, instead of the train passing through the station, it turned into the centre line of rails, and dashed into the front coach of a train which had been drawn up in the usual way preparatory to being sent along the Liverpool platform. The first coach of the standing train was shot into the air, and the underframe of the express was driven under the standing train. Most of the passengers in the first coach were killed outright, and a number were injured and were taken to the Bootle Hospital. The affair spread consternation in the districts all along the line, and out-distanced the terrible disaster of July 13th, 1903.

The inquest was opened on Friday evening last at Great Crosby by Mr. S. Brighouse, county coroner. A letter was read from the signalman, W. Boote, in which he stated that he regretted having turned the 6.30 p.m. train from Liverpool to Southport into the middle siding.

The Coroner said he trusted the travelling public would not be alarmed at the occurrence, or think that the electric service between Southport and Liverpool was not safe. The unfortunate calamity had nothing to do with the electrification of the railway in any shape or form. People had come to him and offered most absurd propositions in connection with the matter. They had evidently, without hearing anything, come to a conclusion in the matter which, to say the least, was most prejudicial. He did not want the travelling public to think they were in any danger from electrification. So far as he could make out, the electrification of the line had not contributed at all to the sad calamity. The inquiry was adjourned till August 10th.

The Board of Trade appointed Lieut.-Colonel E. Druitt, R.E., to hold the Government inquiry into the cause of the collision. The inquiry was opened on Tuesday at Liverpool. The proceedings were private. The Inspector carefully examined the points at Hall Road Station, which were left open by the signalman, causing the accident, and the working of the line generally was explained to him.

An exceedingly clever and gallant act took place near Freshfield on the electric railway on July 26th. Edward Rudd, aged 13, a schoolboy, saw a boy jammed between the electric live rail and the running rail on the Southport line. He covered his hands with his cap and went to the aid of the boy (Robert Partington, aged nine), but the current passed through his cap and hurled him back. Nothing daunted, he whipped off his coat and threw it over Partington, and called to a boy named Smith, who, however, tripped and fell over the live rail. Then another boy came and helped Rudd to place Smith on the bank. They afterwards managed to remove Partington just as a L. and N.W. train was coming. The doctor states that Partington was rescued in the nick of time; he was unconscious when removed from the track.

London.—L.C.C. — On Tuesday the Highways Committee stated that inquiries had been made of several companies with a view to securing a temporary supply of power for working the tramways from the Strand, *via* the subway, to the Angel at Islington. As a result, an offer had been obtained from the County of London Co., which it was desirable to accept. The company would deliver power in bulk to the Council's mains at a point near the Holborn Town Hall, at a pressure of 530 volts; the price to be charged was 1d. per unit, the Council guaranteeing a minimum consumption of 500,000 units per annum, with a maximum demand of 400 KW. It was proposed to enter into an agreement with the company for one year certain, the Council to have the right to obtain a supply for a further period at a price not higher than 1d. per unit. The Committee also proposed to entrust Messrs. J. Mowlem & Co. with the work of reconstructing the tramways in Theobald's Road for the sum of £17,068, as an extension of that company's contract in regard to the lines in Rosebery Avenue, to obtain the special track work for those tramways from the Hadfield Steel Foundry Co. for £8,335, and to procure 16 single-deck cars for use on the lines.

The Council postponed the consideration of recommendations in favour of applying to Parliament in the next Session for powers to construct the undermentioned tramways:—(1) From the Plough, Clapham, *via* Clapham Common north side and Cedars Road, to Lavender Hill tramways; (2) from Seven Sisters Road (existing tramways), *via* Amhurst Park, to Upper Clapton Road (existing tramways); (3) from Aldgate (existing lines), *via* the Tower Bridge Northern Approach, to a point near the Tower Bridge; (4) from the Lea Bridge Road Terminus, *via* Lea Bridge Road, to Upper Clapton Road (existing tramways); (5) from Tooting Broadway, *via* Mitcham Road, to the county boundary near Tooting Junction Railway Station; (6) from High Street Streatham terminus, *via* Streatham High Road, to the county boundary at Norbury, with down line *via* Gleneldon Road, Bournevale Road and Stanthope Road; and (7) from near the Marble Arch, *via* Edgware Road, Maida Vale and High Road, Kilburn, to the county boundary at Cricklewood. The estimated cost of the lines is £414,160.

It was decided to sanction an expenditure of £59,394 for the equipment of the tramways from the Strand *via* the tramway subway to Theobald's Road, and for the reconstruction of the tramways in the latter road to the authorised lines in Rosebery Avenue; an outlay of £53,630 for car-shed and sub-stations in Battersea and Wandsworth; and £30,000 for the foundations and chimney of the second portion of the Greenwich power station.

The Highways Committee reported that it was of great importance, in order to minimise the risk of accidents on the tramways, to ensure that the eyesight of the drivers should be good, and arrangements had been made for the testing of the men. So far the sight of about 340 men had been tested, and it had been found necessary to reject 40 of the men for further service as drivers, either through colour blindness or defective sight generally. The Committee had been anxious, however, that the men declared unfit should not lose employment, but should be provided with other work for which their eyesight would be sufficiently good. It would, therefore, be of interest to learn that out of the 40 men in question, 28 had been given employment as conductors, four as assistant regulators, two as carmen, two as pointsmen, one as a car washer, and one as a vanman, while the remaining two had resigned. It was proposed to continue the practice of finding other employment for drivers whose eyesight proved to be defective.

For the construction of tramways on the conduit system from York Road, Wandsworth, through Garratt Lane, to Tooting, the Committee recommends the Council to accept the tender of Messrs. Dick, Kerr and Co., Ltd., at £96,242 3s. 7d. The engineer's estimate for the work was £98,736 5s. 6d.

The reconstruction of the horse tramways from North Street, Wandsworth, to Westminster Bridge is also to be taken in hand, and the Committee recommends the acceptance of the tender of Messrs. J. G. White & Co., Ltd., at £163,874 11s. 2d. In this case the engineer's estimate was £165,491 4s. 10d. In the first case paving work for the street widenings is included in the tender, but in the second case the tender is exclusive of this work.

METROPOLITAN RAILWAY.—Whilst being shunted into a siding between Moorgate Street and Aldersgate last week, an electric train on the Metropolitan Railway came into contact with the wall, and became wedged. A quantity of brickwork was dislodged and the footboard of the train was broken off. The accident was, doubtless, due to the great length of the new coaches and the overhang in going round curves. The train service was not interrupted.

C.L. RAILWAY.—According to the *Daily Mail*, fire broke out in a carriage on the Central London Electric Railway on Monday last, but two officials suppressed the outbreak with a fire extinguisher before serious damage was done.

DEPTFORD.—Notice was received from the electrical engineer of the L.C.C. by the Borough Council on Tuesday of intention to lay underground electric mains in Lewisham High Road in connection with the proposed tramways. He wrote in reply to a suggestion previously received from the local authority, that he could not agree to lay the ducts only under the tramway margins or in the clear way between the tracks, unless there should not be sufficient room for them under the footpaths, and he pointed out that the L.C.C. was acting in the matter under Clause 6 of the Electrical Power Act of 1900. The surveyor was authorised to interview the electrical engineer of the London County Council with a view to an amicable arrangement being arrived at.

DISTRICT RAILWAY.—On Tuesday last, on the section of the District Railway between Richmond and Whitechapel, the steam trains were superseded by electric trains, about 20 of which were running. The section between Whitechapel and New Cross continues to be served, the trains withdrawn between those two stations being made up for by a service supplied by the London, Brighton and South Coast Railway. The Wimbledon to East Ham service and the Circle service will continue to be supplied as at present.

L. T. and S. Railway.—The directors in their report say that the work of widening the line between Bow and Barking is approaching completion, and the electrical equipment of the section between the junction with the Whitechapel and Bow Railway at Campbell Road, Bow, and East Ham, is finished. The District Company's electric trains will shortly be extended to East Ham.

Metropolitan District Railway.—The report for the half-year says that the introduction of zone fares has been postponed pending the complete installation of electric traction and the consequent increased train service. The work of electrification is now practically completed. The power house is in working order. The sub-stations are completed, and the whole of the cables are laid throughout the company's system. Electric trains are now running between Ealing and Whitechapel, and from Harrow to Mill Hill Park, and from Hounslow to South Acton. A service is also running between High Street, Kensington, and Putney. Further electric trains will from time to time, as cars are delivered, be brought into running in substitution for the steam service. With a view to provide the balance of the moneys required for electrical equipment and to meet other obligations, it is proposed to sell surplus freehold lands and properties of the company to the value of £250,000.

Metropolitan Railway.—At the half-yearly meeting on 27th ult., Sir Charles McLaren, M.P., the chairman, said that some alteration had been made in their classes, consequent upon bringing into traffic their new electrical cars, which were of two classes only, and therefore between all stations from Baker Street to Harrow and Uxbridge, and from those stations to the "circle," they now issued only first and third-class tickets. They would do the same thing as regarded persons travelling between Hammersmith and stations on the "circle" so soon as the electrical service was in full working on that line, and he thought that he might say now that they would have only two classes between Harrow and Verney junction in the near future. It was proposed to pay a dividend at the rate of 2½ per cent. per annum. Of course, they did not like to see a smaller dividend declared, but in the present instance the circumstances were altogether exceptional, and a temporary decline in the rate of distribution was fully expected by the board, and also by those shareholders who were acquainted with the circumstances. The necessity of working by steam and electricity at the same time, as he pointed out last January, was unavoidably attended with greater expense than the working by one system alone, and, while they would not keep steam trains on the "electrified" portion of the line for a day longer than was necessary, it was absolutely essential to use both forms of motive power for a time, until the staff got thoroughly used to the working of the electrical trains. That transition was not yet completed, nor did the directors expect that it would be for another six months. The cost of making the change from steam to electricity was proving rather greater than was at one time anticipated, but he was perfectly satisfied that they had taken the right course, and that in a short time they would reap the benefit of the alteration. It was only right to say that they were again passing through a very trying half-year, because they had not yet wholly surmounted the difficulties of transition. The company commenced on January 1st last to run some electric trains between Baker Street and Harrow, and between Harrow and Uxbridge. The number of these trains had been gradually increased until the whole of the service on the extension lines between Baker Street and Harrow and Uxbridge was now worked electrically, though they still had the trains from Baker Street to and from stations beyond Harrow, on the Aylesbury line, worked by steam. They had had some few failures and stoppages while bringing in the electrical service, but nothing of a serious character, and certainly nothing more than might be regarded as inevitable in the making of so radical a change. With reference to the working of the "circle" by agreement with the District Co., they made arrangements to commence to work all the trains on the "up" road electrically on the 1st inst., but, unfortunately, the service over the District Co.'s part of the "circle" had to be discontinued in the course of a few

hours, as certain difficulties became apparent in connection with the conductor rails and car equipments. The matter was still in negotiation with the District Co., with a view to deciding upon the necessary slight alterations to be made, and they hoped to be in a position very soon to resume continuous working round the "circle" with electric trains. In the meantime this company was running a service of electric trains between 7 a.m. and midnight in addition to the ordinary service of steam trains on their portion of the "circle," namely, between South Kensington and Aldgate, *via* Paddington. Mr. Parker, the consulting engineer, had stated that there seemed to be little doubt that they would ultimately be able to produce their energy at the low figure of ½d. per unit.

Middlesex.—It was resolved by the County Council, on July 27th, that subject to the Herts County Council agreeing to construct its authorised light railway from the Middlesex and Herts boundary to Watford, the necessary steps be taken with a view to application being made in November next to the Light Railway Commissioners for an Order authorising the Middlesex County Council to construct a light railway 2½ miles in length, from the Edgware Road at its intersection with Watford Road, through the village of Great Stanmore, and terminating in the Bushey Heath Road at the boundary of the counties of Middlesex and Hertfordshire. The county engineer was authorised to engage temporary assistance in connection with the light railway scheme.

Morley.—At a meeting of the T.C. on Monday, the town clerk was instructed to write to the British Electric Traction Co. stating that the Corporation was anxious to have the Morley tramways completed with as little delay as possible, also to ask the company if it would give an undertaking that the light railway would be completed within the period if the Council agreed to the company's application for an extension of time. In the event of the reply being unsatisfactory, the town clerk will submit the whole facts to the Board of Trade. The company has already obtained one or two extensions of the Spen Valley and Morley Light Railways Order, and is now applying for a further extension.

Salford.—At the Manchester Assizes last week, John Trueman brought an action against the Corporation to recover damages for personal injuries sustained in consequence of the negligence of the Corporation tramway service. The plaintiff's case was that while riding on the outside of a Salford tramcar on August 30th, 1904, he was struck by the trolley pole, which was hanging loose. The blow rendered him unconscious, and he had since suffered from nervousness. Negligence was admitted, and the jury awarded plaintiff £90.

S. E. Railway and Tramways Competition.—In his address to the S.E.R. shareholders on July 31st, Mr. Cosmo Bonsor said that the competition of the electric tramways had drawn from the railway a large number of their short-journey passengers; the principal districts in which they had suffered were Brixton, Peckham, and the neighbouring stations. They could not expect to compete satisfactorily with the electric tramways, but the traffic taken from them was not particularly profitable, and they also had the consolation of knowing that when they came to appeal against the assessments in the districts mentioned they would be able to plead for a reduction in the amount of the rates paid by them by referring to the competition set up against them.

South Africa.—DURBAN.—Further extensions of the municipal tramways are being projected, to include duplication of the track along Umbilo Road from Berea to Davenport Road, and also the Alice Street extension to Old Dutch Road to be followed later with the Umgeni Road extension. The doubling of the track in Berea Road has been completed as far as Musgrave Junction, and was put into use on the 1st ult., affording a 5-minute service in place of 7½-minute.

West Ham.—The accounts of the Corporation tramways for the year ending March 31st last show that the gross profit for the year was £23,198. Of this sum £9,020 is absorbed by interest on the undertaking, and £7,418 by the sinking and renewal fund, and £7,000 has been allotted to the relief of rates.

TELEGRAPH AND TELEPHONE NOTES.

Internal and External Telegraph Charges of the Australian Commonwealth.—The dates of adhesion to the International Telegraph Convention of the various Colonies now forming the Commonwealth and New Zealand are as follows:—South Australia, May 27th, 1878; New Zealand, June 3rd, 1878; Victoria, January 1st, 1880; New South Wales, February 25th, 1884; Tasmania, July 8th, 1885; Western Australia, January 1st, 1894; Queensland, April 9th, 1896; Commonwealth, January 1st, 1903; Eastern Extension Co., May 1st, 1963.

As regards telegrams external to the Commonwealth, the internal and transit charges exacted are identical, and, as notified by the Berne International Office in its notification No. 541, June 1st, 1902, as follows:—For Government telegrams, 41·6 centimes per word; for ordinary private telegrams, 52·08 centimes per word; for Press telegrams, 20·8 centimes per word.

The present share taken by the Eastern group in the rates for telegrams to Australia and New Zealand is divided up as follows:—

	To Australian Commonwealth.	To New Zealand.
Europe to coast of Australia ...	3·2292 fr.	2·8292 fr.
Commonwealth	·5208 fr.	·5208 fr.
Australia-New Zealand cable ...	—	·30 fr.
New Zealand	—	·10 fr.
	3·75 fr.	3·75 fr.

Telegraph Rates in Australia and New Zealand.—The present internal charges for telegrams throughout the Australian Commonwealth are as follows:—

For telegrams within the boundaries of each State, 16 words, including signature and address, town and suburban within prescribed limits, or within 15 miles from the starting station	6d.
Other offices	9d.
Extra words, each	1d.
Press Rates.—25 words and under	6d.
Exceeding 25 words, but under 50	6d.
Exceeding 50 words, but under 100	1s. 6d.
For every additional 50 words or portion thereof ...	9d.

Between the various States of the Commonwealth—

16 words, including signature and address	1s.
Extra words, each	1d.

Press rates:—

25 words and under	1s.
Exceeding 25 words, but not 50	1s. 6d.
Exceeding 50 words, but not 100	3s.
Every additional 50 words, or portion thereof ...	1s.

(Address and signature not charged for.)

In addition to the rate for ordinary telegrams to Tasmania, a cable charge of ½d. per word is added. On Press telegrams from and to Tasmania, the charges to be as follows:—100 words or under, 1s.; each additional 50 words or under, 6d. extra. Double prescribed rates are charged on telegrams (Press excepted) tendered for transmission after usual business hours, and on Sunday, Christmas Day, Good Friday; and on other days between 6 p.m. and 7 a.m., and for "urgent telegrams."

The charge to or from New Zealand and any of the States of the Commonwealth is 4½d. per word to the public, with the exception of Tasmania, when the charge is 5d. per word.

The internal rate throughout New Zealand is as follows:—For the first 12 words, or less, including address and signature, 6d. for ordinary telegrams; for every additional word, 1d. For urgent telegrams the first 12 words or less, including address and signature, 1s.; for every additional word, 2d. On Sundays, for offices which open both morning and evening, the above rates; at other offices, double the above rates.

The terminal tax of ½d. per word is charged by New Zealand for messages exchanged with the Australian Commonwealth, except Press messages; for all other messages the terminal tax is 1d., as against 5d. per word charged by the Commonwealth.

London.—MARYLEBONE.—Mr. Paul Taylor sat last week as arbitrator in a dispute between the Postmaster-General and the Marylebone Borough Council. The local authority claimed a sum from the Post Office for repairs to thoroughfares after the laying of underground wires, and until that money was paid it declined to allow other wires to be laid. After a protracted hearing Mr. Taylor decided that the wayleaves appled for by the Postmaster-General ought to be granted by the Council, irrespective of any dispute as to the cost of previous transactions between them.

London-Rome Telephony.—A special instrument invented by an Italian professor, Q. Majorama, is now being experimented with for telephonic purposes between London and Rome. The central office at London clearly heard every word of a conversation with Rome, although the distance is more than 1,500 kilometres as the crow flies.—*Revue de l'Electricité.*

Telegraphic Interruptions and Repairs:—

	Interrupted.	Repaired.
Cables.		
Trinidad-Demerara (No. 2)	July 28, 1905	
Trinidad-Demerara (No. 1)	Aug. 26, 1901	
St. Lucia-Martinique	May 7, 1902	
Dominica-Martinique	May 7, 1902	
Cayenne-Pinheiro	Aug. 13, 1902	
Reissa-Issa (Yemen) Camaran	Oct. 22, 1902	
Tarifa-Tangier	Jan. 18, 1904	
Closed { Vladivostock-Nagasaki	Feb. 9, 1904	
Closed { Port Arthur-Chifu	Mar. 9, 1904	
Jamaica-Colon	Jan. 5, 1905	
Bolama-Bissao	June 21, 1905	
Iquique-Antofagasta	July 21, 1905	
Antofagasta-La Serena	July 21, 1905	July 29.
Cadiz-Tenerif	July 20, 1905	
Paramaribo-Cayenne	May 25, 1905	
Lagos-Kotonon	July 29, 1905	
Landlines.		
Puerto-Barrios	July 28, 1902	
Kertch-Soutehoum	Sept. 27, 1904	
Alaska landlines	July 10, 1905	
Communication with Brazil *via* Galveston	July 18, 1905	

Wireless Telegraphy in America.—According to the *Daily Express*, Father J. F. Murgas, of Wilkesbarre, California, has invented a new system of wireless telegraphy, for which he has been paid £20,000. We take no responsibility for the accuracy of the report.

CONTRACTS OPEN AND CLOSED.

OPEN.

Acton.—August 21st. Arc lamp carbons and house fuse boxes for 12 months for the U.D.C. See "Official Notices" to-day.

Dublin.—August 15th. Alterations to coal storing and conveying plant at Pigeon House generating station. See "Official Notices" to-day.

Ebbw Vale.—August 5th. Cables, overhead lines, street lamps and fittings, and meters, for the U.D.C. See "Official Notices" July 14th.

India.—August 9th. The Secretary of State for India is inviting tenders for:—(1) Rolled material for wagons. (2) Electric travelling cranes (40 tons). Conditions on application to the Director-General of Stores, India Office, Whitehall, S.W.

Mussoorie (India).—October 23rd. Supply and erection of steel power pipes, water motors, alternators with exciters, switchboards complete, transformers, induction motors, pumps, workshop machines; also bare copper overhead mains, insulators, and lightning arresters, arc and incandescent lamps, telephone equipment, workshop tools and general stores. See "Official Notices" July 14th.

Spain.—August 19th. The Director-General of the Telegraph Department, Carretas, 10, Madrid, invites tenders for the supply of 50 tons of galvanised iron wire, 4 millimetres in diameter and 5 tons of bronze wire 2 millimetres in diameter. The *Standard* says that the maximum price at which tenders will be received is 1,570 pesetas (about £47) per ton for galvanised iron wire, and 3,450 pesetas (about £108) per ton for bronze wire. A deposit of 5 per cent. of the value of the goods at the upset price is required to qualify any tender. "A foreigner, when entering into contracts for the performance of public works in Spain, must renounce by public act all rights to which he might be entitled by virtue of the law of his own country in so far as his contract is concerned, and accept any administrative decisions that may be issued respecting questions arising from that contract. In entering into such contracts a local agent is a practical necessity."

Spain.—September 20th. The Directorate-General of Public Works, Madrid, is inviting tenders for the concession of an electric tramway in Zaragoza. The *Standard* says that an application for this concession has already been made by the Zaragoza Tramways Co., who, at the same rates, will enjoy certain preferential rights over other tenderers. The competition will turn, in the first place, on the reduction of the tariffs proposed; and if two or more identical propositions are made, a further competition will take place verbally as to what reduction (if any) of the period (60 years) of the concession tenderers may be prepared to accept. Deposit 474 pesetas (£14).

War Office.—September 1st. Tenders invited for the purchase of surplus boilers, dynamos, &c., at Bermuda, Barbados, St. Helena and Woolwich. See "Official Notices" July 7th.

CLOSED.

Bolton and Bury.—The Corporation has accepted the tender of Triumph Stoker, Ltd., of London and Leeds, for two more of their mechanical stokers for the new boilers for the electricity works. The Bury Corporation has also accepted the tender of the same company for stokers for its electricity works.

Camberwell.—The B.C. has accepted the tender of H. M. Leaf, at £881 (including £250 for fittings, &c.), for wiring the new baths in Old Kent Road.

Fulham.—The following tenders were received by the Electricity Department for contract P for the supply and construction of extension of cables, feeders, &c. That of Messrs. W. T. Henley's Co. was accepted by the Council:—

W. F. Dennis & Co., Ltd.	£1,779 7
Johnson & Phillips' Electric Cable Works	1,780 4
The Electrical Co., Ltd.	1,905 7
British Insulated & Helsby Cables Co. (stoneware ducts)	2,000 8
Do. do. (fibre ducts)	2,064 18
Western Electric Co.	2,043 19
Do. do.	2,115 19
W. T. Henley's Telegraph Works (fibre ducts) (accepted)	2,075 3
Do. do. (stoneware casing)	2,012 3
Callender's Cable Construction Co.	2,014 2
W. T. Glover & Co., Ltd.	2,132 8
St. Helens Cable Co., Ltd.	2,209 0
Do.	2,315 15
Siemens Bros. & Co., Ltd. (fibre conduit)	2,362 10
Do. do. (stoneware casing)	2,295 0

G.P.O.—The Post Office Telegraphs Department have accepted Messrs. Johnson & Phillips's tender for 8 miles 7/23 V.I.R. cable.

Islington.—The B.C. has received the following tenders:—

One 1,500-kw. turbo-generator exciter, condensing plant, &c.:—

Mather & Platt	£14,660
British Thomson-Houston Co. (Mirlees-Watson condenser)	10,064
Do. (Worthington condenser)	9,682
Do. (Allen's condenser)	9,680
Bruce Peebles & Co. (Parsons turbine)	9,750
Do. (British turbine)	8,811
Do. (Richardsons, Westgarth turbine)	8,170
Willans & Robinson (Bruce Peebles alternator)	9,078
Do. (General Electric Co's alternator)	8,341
Do. (Dick, Kerr's alternator) (accepted provisionally)	8,258
Brush Electrical Engineering Co.	8,477
British Westinghouse Co.	8,430
C. A. Parsons & Co.	8,405
General Electric Co. (Parsons turbine)	8,192
Do. (Brush turbine)	7,445

Natural Draught Cooling Tower.

Richardsons, Westgarth & Co.	1,852
E. F. Jarvis	1,580
Worthington Pump Co.	1,226
Mather & Platt	1,180
Balcke & Co. (accepted provisionally)	1,118
Klein	1,107
Rossland	1,090
Couper	940
Zschocke	940

800 ft. of 20-in. diameter steel riveted pipe for circulating mains, together with 12 bends of the same diameter:—

Spencer & Co. (accepted provisionally)	£446 12 0

London.—The Highways Committee of the London County Council has received the following tenders for the reconstruction of the tramways from North Street, Wandsworth, *via* York Road, Battersea Park Road, &c., to Westminster Bridge, including lines in Lambeth Road and Falcon Road:—

	Tramways work.	Paving works for street widenings.	Total.
J. G. White & Co. (recommended)	£163,874 11 2	£35,371 3 4	£199,245 14 6
Dick, Kerr & Co.	169,736 8 0	30,483 2 3	200,219 10 3
W. Griffiths & Co	173,830 4 1	30,547 14 2	204,377 18 3
George Law, Kidderminster	177,284 19 6	27,370 0 6	204,655 0 0
Muirhead, Greig & Matthews	175,548 12 4	35,066 9 7	210,615 1 11
Engineers' revised estimates	£165,491 4 10	£33,491 14 7	£198,982 19 5

The undernoted tenders have been submitted for the supply of one 5-ton and one 2½-ton overhead travelling crane for use at the New Cross car-shed:—

Carrick & Ritchie	£859 0 0*
Herbert Morris & Bastert	881 13 7*
John Hitchen & Son	915 0 0
	980 0 0
	1,010 0 0
Joseph Booth & Bros.	952 6 0
Jessop & Appleby Bros. (Leicester and London), Ltd. (recommended)	1,009 0 0
Thomas Broadbent & Sons	1,102 2 0*
Leeds Engineering and Hydraulic Co.	1,128 17 0
C. & A. Musker (1901), Ltd.	1,134 4 0
Dewsbury Electric Manufacturing Co.	1,230 5 0
James Spencer & Co.	1,310 0 0
John Musgrave & Sons	1,498 0 0

The tenders marked with an asterisk were not to specification.

London.—The County of London Electric Supply Co. have placed an order with Messrs. Johnson & Phillips for a number of hot-wire ammeters and transformers.

Loughborough.—The following tenders for a year's supply of stores, &c., have been accepted by the Electricity Committee:—

No. 1.—Oils. (16 tenders.)

Highest	Valvoline Oil Co.
Lowest	Blumann & Stern.
Accepted	Valvoline Oil Co.

No. 2.—Engine Room Stores. (12 tenders.)

Highest	United Asbestos Co.
Lowest	George Hatch, Ltd.
Accepted	George Hatch, Ltd.

No. 3.—Cables. (15 tenders.)

Highest	Siemens Bros. & Co.
Lowest	St. Helens Cable Co.
Accepted	W. T. Henley's, Ltd. (Second lowest.)

No. 4.—Cable Accessories. (18 tenders.)

Highest	W. T. Glover & Co.
Lowest	Siemens Bros. & Co.
Accepted	W. T. Henley's, Ltd. (Second lowest.)

No. 5.—House Service Meters. (12 tenders.)

Highest	General Electric Co.
Lowest	International Elec. Co.
Accepted	B.T.H.Co. (Second lowest.)

No. 6.—Switches and Fuses. (23 tenders.)

Highest	Johnson & Phillips.
Lowest	Marples, Leach & Co.
Accepted	Marples, Leach & Co.

No. 7.—440-volt Motors and Starters. (21 tenders.)

Highest	Brush Elec. Eng. Co.
Lowest	Rhodes Elecl. Co.

Recommended for acceptance:—Brush Electrical Engineering Co.

No. 8.—220-volt Motors and Starters. (14 tenders.)

Highest	Brush Elec. Eng. Co.
Lowest	Crompton & Co.
Accepted	Crompton & Co. / Bray, Markham and Reiss.

No. 9.—Ironmongery, Sundries, (8 tenders.)

Highest	Wm. McGeoch & Co.
Lowest	W. Armstrong & Son.
Accepted	W. Armstrong & Son (Loughborough).

No. 10.—House Service Fuses. (19 tenders.)

Highest	W. F. Jones.
Lowest	W. T. Henley's, Ltd.
Accepted	W. T. Henley's, Ltd.

No. 11.—Turbine Generator Brushes (2 tenders.)

Highest	C. A. Parsons.
Lowest	Brush Elec. Eng. Co.
Accepted	Brush Elec. Eng. Co.

Hull.—The Corporation E.L. Committee on Friday accepted the following tenders :—

Ferranti, Ltd., switchboard (first half), £3,350.
Oldham Boiler Co., six Lancashire boilers, £4,013.
Lahmeyer Electrical Co., Ltd., high-tension steam dynamo, £4,066 3s., low-tension ditto, £3,838 15s.

Metropolitan Asylums Board.—The Board has accepted the tender of Messrs. Johnson & Phillips for a year's supply of cables, concentric for c.c. system, and flexible wires.

Middlesex.—The County Council has accepted the tender of Messrs. Dick, Kerr & Co., at £776, for constructing junctions and cross-over roads at the Stanbridge Park tramway depôt.

Stepney.—The B.C. has accepted an offer by the Underfeed Stoker Co., Ltd., for an automatic stoker, to be six months on trial, and if successful it is to be purchased for £452. If unsuccessful, a rental of £30 is to be paid.

REVIEWS.

Elektrische Traktion. By G. Sattler. Being the eleventh volume of "Repetitorien der Elektrotechnik." Edited by A. Königswerther. Hanover : Gebrüder Jänecke. 1905. Price M. 4.20.

As indicated by the title of the series to which it belongs, this book contains a summary of information connected with electrical traction. The small space available has compelled the author to confine himself more especially to standard electric tramway practice, so that whilst failing to give anything like a complete summary of electrical traction in general, he has succeeded in giving a connected and well-arranged account of this particular part of the subject.

A previous knowledge of the elements of the subject is assumed, although the derivation of the various formulæ used is generally sufficiently indicated. In order to save space, all the figures are diagrammatic, and no merely descriptive photographs are included.

The book is divided into nine short sections on the following subjects :—The resistance to motion of electrically-driven vehicles, motors for electric traction, the calculation of the energy consumption, the calculation of the supply cables, the laying of the cables, the overhead construction, methods of current supply and collection, electrical automobiles, and quantity and price estimates.

The sections dealing with the line are more complete and detailed than those dealing with the design of the motors and their regulating apparatus, but this is, perhaps, advantageous, as the latter subject is far more fully dealt with than the former in the ordinary text-books.

One or two errors have crept into the book, such as the figure on p. 27, which shows the motors short-circuited instead of connected in parallel on certain steps of the controller, also some confusion between metres, centimetres and millimetres on pp. 113, 115 and 126. But the information is, on the whole, accurate and the book should prove useful for reference purposes both to the advanced technical college student, and to the junior tramway engineer.

Über den Wirkungsgrad und die practische Bedeutung der gebräuchlichsten Lichtquellen. By W. Wedding. München and Berlin : R. Oldenbourg. 1905.

This short monograph, reprinted from the *Journal für Gasbeleuchtung*, forms an interesting and valuable contribution to the vexed question of the relative advantages of various sources of light. The first part is given up to a description of the apparatus used and of the results obtained in a series of comparative tests carried out on typical examples of the following sources of light :—(1) Petroleum lamp ; (2) Petrol incandescent lamp ; (3) Incandescent gas lamp ; (4) High pressure gas lamp ; (5) Lucas lamp ; (6) Millennium light ; (7) Incandescent electric lamp ; (8) Osmium lamp ; (9) Nernst lamp ; (10) Arc lamp (ordinary and flame). The chief object of these tests was to determine exactly what percentage of the total energy was effective in producing the visible rays. For this purpose a sensitive bolometer, in combination with a delicate Wheatstone bridge arrangement for measuring the resistance, was used. From the temperature rise of the bolometer grids the total (visible and invisible) energy radiated per 1 sq. cm. of the surface of a 1-metre radius sphere surrounding the lamp, was first determined, and then, by interposing a vessel of water between lamp and bolometer, the heat rays were completely filtered out, and practically a direct measurement of the visible ray energy was obtained. The following information is tabulated for each lamp :—

1. The mean total energy radiated per 1 sq. cm. of a 1-metre radius sphere.
2. The mean value of the energy actually producing light per 1 sq. cm. of a 1-metre radius sphere.
3. The efficiency of the lamp stated as the ratio of the number of watts actually effective and producing rays to the total number of watts absorbed in the lamp (in the case of material combustibles, the total watts absorbed were determined from the weight consumed and the calorific value of the material).
4. The ratio of the total light radiated above the horizontal plane to that radiated below it.

Complete candle-power curves and curves of energy radiated at all angles are also given in each case, but there is no information as to the photometric methods employed.

Part I. concludes with a convenient table summarising all the results, and also giving the cost per candle-power-hour and the volume of carbonic acid liberated per hour in each case.

It is interesting to note that whilst the efficiencies of the lamps, though always under 1 per cent., differ widely, the visible ray energy per candle power is almost constant, ranging only from 10^{-7} to 10^{-8} watts per sq. cm. of a 1-metre radius sphere.

In the second part of the paper Prof. Wedding points out the impossibility of coming to any general decision as to the superiority of one source of light over another. The cost per candle-power-hour alone forms no safe criterion, and for every particular case, such as the lighting of small living rooms, the lighting of workshops, shop windows, streets, &c., the effects of a number of factors must be separately considered. The mean spherical or hemispherical candle-power, the steadiness and colour of the light, the heat and the burnt products given off, the cost of attendance and upkeep are some of these factors, and it is only after a thorough consideration of these that a just decision as to the advisability of employing one form of light rather than another in any particular case can be arrived at.

A fairly complete qualitative examination of this sort for half a dozen typical cases is given, and some of the conclusions arrived at are that : For the "small man," with whom cheapness is the first consideration, the ordinary petroleum lamp probably still holds the first place. For the lighting of the better class houses and workshops, severe competition exists between incandescent gas lamps and the various types of electric incandescent lamps, whilst for large halls and for street lighting there are indications that the supremacy of the arc lamp may be interfered with by the new types of high pressure gas lamps.

The Induction Motor as Generator.—In the May number of the *Journal* of the South African Association of Engineers, besides discussions and replies to discussions on various papers previously read, there was included a paper by Mr. T. P. E. Butt on the subject above named. The author described some experiments which he had carried out in connection with a proposal to supply a portion of the lighting of Johannesburg from the electrical plant of the Robinson Deep G.M. Co.; additional plant was required for the purpose, and Mr. Butt suggested that a disused induction motor of 300 H.P. should be utilised as a generator, being driven from one of the mill engines of 500 H.P. A disused plating dynamo provided exciting current, which was supplied to the rotor through the ordinary slip rings, the rotor winding being of the three-phase type ; two of the branches were put in parallel with one another, and in series with the third, this connection being found more economical than to omit one branch altogether. Under these conditions the machine worked well as a generator, giving normally 260 KW. as a maximum, and up to 315 KW. on emergency, with an excitation of 8·4 KW. at the last-named load. With a lighting load of 220 KW. the excitation was 4·5 KW. The results were considered very successful, and obviously the possibility of quickly converting an induction motor into a generator without impairing its qualities as a motor is a decided advantage, for which it has not usually received due credit.

FORTHCOMING EVENTS.

Saturday, August 5th.—At 2 p.m. North of England Institute of Mining and Mechanical Engineers. Annual general meeting at Newcastle. "The Determination of the Specific Electrical Resistance of Coal, Ore, &c.," by G. C. Wood.

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

The following orders have just been issued:—

Thursday, August 10th.—Recruits and non-efficients for Isle of Wight Camp, parade at Waterloo Station (L. and S.W.R.) at 12 noon.
Saturday, August 12th.—Efficients for Isle of Wight Camp, parade at Waterloo Station (L. and S.W.R.) at 12 noon.

J. J. F. O'Shaughnessy, Captain.
For O.C.E.E.R.E.(V.).

NOTES.

The Administrative Power Bill.—It is more than probable that the consideration of this Bill by Sir James Kitson's Committee will have been brought to a conclusion before this issue reaches our readers' hands. On Wednesday the Hon. J. D. Fitzgerald, K.C., on behalf of the promoters, said that he was informed by the Parliamentary agents that unless the Committee stage of the Bill were finished by Thursday evening there would be considerable danger of the Bill being lost, simply by effluxion of time. Under those circumstances he had to ask the Committee to sit late on Wednesday and Thursday to enable the Committee stage to be finished and a decision given on Thursday evening. He was aware that that might put the members of the Committee to considerable personal inconvenience, and undoubtedly must increase the strain on them, but having regard to the time spent in Parliament, and the great expenditure incurred by the parties, it would be a great misfortune if the Bill were lost. The Chairman, in reply, said he felt a very great responsibility in view of the interest raised in Parliament in the issues before the Committee, and he would accede to the request.

Educational Notes.—The June issue of the *Faraday House Journal* is of special interest, as it contains a full description, with illustrations, of the new premises of the Electrical Standardising, Testing and Training Institution at Faraday House, 66-70, Southampton Row, W.C. A historical sketch of the Institution is also given, commencing with its foundation, on the initiative of Mr. Robert Hammond, at No. 2, Red Lion Square. Then, as now, Mr. Hugh Erat Harrison, B.Sc. (London), was principal.

The new building, which has been erected specially for the purposes of the Institution, is much larger than the one which it occupied for 15 years in Charing Cross Road, and is constructed of steel and concrete, with a Richmond-Carey electric lift and other modern conveniences. The workshops are well equipped with machine tools, steam and gas engines and dynamos; storage batteries are provided; there are three lecture rooms, a drawing office for 70 students, physical and chemical laboratories, library and offices, in addition to the standardising and testing department, which is fitted up for testing instruments, lamps, cables, iron and steel, and special work. The building was wired by Messrs. Edwards & Armstrong, of Bristol (a firm of old students), to the designs and specifications and under the supervision of Mr. Percy Good, and every facility is provided for obtaining any desired current and voltage wherever necessary. Mr. Alexander Russell, M.A., is the lecturer in mathematics and physics; Mr. J. Thomas, B.Sc. (London), in chemistry; Prof. C. A. Carus-Wilson, M.A., in dynamo and motor construction; Mr. W. H. Bell, A.M.Inst.C.E., in mechanical engineering; Mr. P. Good, superintendent of the Standardising Department, assisted by Mr. H. C. Silver, and Mr. Howard Foulds is the secretary. We heartily wish the Institution every success in its enlarged sphere of work.

Electricity in Mines: Responsibility of Managers.—At Wakefield, Mr. William Stewart, on 28th ult., was summoned, as manager of the Crigglestone Colliery Co., for having failed to see that a coal-cutting machine was so worked and maintained as to reduce the danger from accidental shock or fire to a minimum, and further with failing to have the underground cables suspended by leather or other flexible material. Mr. W. M. Gichard, Rotherham, who prosecuted for the Home Office, said that on the night of June 2nd an explosion of gas occurred in Crigglestone Colliery, caused by one of the coal-cutting machines, the switch-box of which was afterwards found to be defective through the absence of the india-rubber ring, through which the electric cables ought to pass. The defence was, that a manager could not be held responsible for every trifling dereliction of duty on the part of those engaged in the mine. The charge of non-suspension of the cables upon flexible material was dismissed, but on the other summons the Bench held the defendant responsible, and imposed a penalty of £5 and costs.—*Yorkshire Daily Post.*

Earl's Court Exhibition.—The Commercial and Industrial Sections of this Exhibition are now thoroughly complete, and full of up-to-date interest. The splendid collections sent from Newfoundland by the Government of that colony have only now been arranged, owing to delay in their arrival. Most of the large shipbuilders and shipping companies have extensive displays. We referred to the various interesting exhibits on page 1053 of our issue of June 30th.

"Tit-Bits" Science.—"Newspaper Science" has a well-defined meaning, and we may now add the expression "Tit-Bits Science" as likely to become not less notorious. It is not so very long ago that the readers of that periodical were informed of the existence of a pneumatic tube extending between London and Glasgow, by which telegrams were regularly dispatched. Doubtless a careful search through the columns of the same paper would unearth other instances of equally valuable and accurate information. In a recent issue under the head of "When the Telegraph Wire is Broken," we have the following charming effusion (paid for, it seems, at the rate of two guineas per column):—

"Have you never wondered how, when a wire is broken or damaged, say, between London and Birmingham, or between England and Ireland, the operator, sitting in his office, can tell exactly where the accident has occurred?

"The explanation is very simple. It requires force to send electricity through a wire. The longer the wire is the greater is the force required. This force is measured; but, instead of calling it pounds, as in measuring the pressure in a boiler, electricians call the units of electrical force 'ohms.'

"Suppose a wire between two offices is 150 miles long, and that, on a stormy night, it gets broken somewhere. The telegraphist knows that when the wire was sound it took just 2,100 ohms to send a current through, or 14 ohms per mile. He now finds that he can send a current with only 700 ohms. He divides 700 by 14, and finds that the break in the wire is 50 miles from his end."

Truly the proprietors of "Tit-Bits" are to be congratulated on the profound knowledge possessed by their science editor; we feel tempted to secure his services for the Electrical Review, but are afraid that his rate of remuneration would be beyond our means.

An Electrical Census of New South Wales.—The Statistical Register for New South Wales (1905) gives, on page 421, a list of the number of electric supply works, hands, employment, and value and horse-power of plant in the colony between 1894 and 1903 inclusive. In 1894, 21 works employed 98 persons to look after plant aggregating 1,756 H.P., valued at £89,765. At the end of 1903, the number of works had increased to 72, the number of persons employed to 434. The aggregate horse-power at full capacity had risen to 21,994, and the value of plant and machinery to £528,587. The section devoted to industrial wages gives the following average rates of weekly wages ruling in central stations:—Electricians, £2 8s. to £2 10s. 5d.; assistant electricians, 18s. 2d.; managers, £6; wiremen, £2 0s. 6d. to £2 5s. 3d.; linemen, £2 10s. 3d.; fitters, £2 12s. 6d.; engine drivers, £2 16s. 9d.; engineers, £3 16s. 10d.; assistants, £1 15s. 2d.; lamp trimmers and carboners, £2 8s. and £2 1s. 3d. respectively. Firemen are said to get an average of £2 6s. 7d. Outside purely electrical works, electricians receive varying wages; when employed in the making of scientific instruments, £2 15s.; in shipyards, £3; in factories, making of vehicles, and in paper or printing works, £2 10s.; while in factories connected with the preparation of food and drink, £3 4s. 8d. is paid. Electroplaters average £2 0s. 11d., and their assistants from 7s. 4d. to 16s. 3d. There does not seem to be enough elbow room or financial incentive in New South Wales to attract many students from British technical colleges or "improvers" from works or central stations. With fitters and linemen earning twice as much as "assistant electricians," the conditions as to overcrowding seem quite homelike and familiar.

Smoke Prosecution.—At the Birkdale Police Court, on the 20th inst., the Lancashire and Yorkshire Railway Co. were summoned for causing a nuisance by the emission of black smoke from the chimney of the electric generating station at Altcar, near Formby. The offence was admitted on behalf of the company, it being explained that at the time of the nuisance certain alterations were being made to the plant and machinery at the power station, in consequence of which a nuisance was caused, but when those alterations were completed it was hoped there would be no recurrence of the offence. Mr. W. H. Watson, on behalf of the prosecution, applied for an order of abatement and prohibition, which was made by consent.

Tug-of-War.—On Wednesday, July 19th, the tug-of-war team attached to the Hanwell depôt of the London United Electric Tramways, Ltd., won a silver cup presented by the Acton Horticultural Society at the annual Flower Show in Acton Park. They had to compete against teams from the Central London Railway, Chiswick Police, Acton Police, and Great Western Railway. The team are a great credit to their coach, Mr. M. Balfe, the assistant superintendent of the Hanwell line. They are the holders of the "Clifton Robinson" Tug-of-War Challenge Cup.

South African Notes.—At a meeting of the South African Institute of Electrical Engineers, Mr. W. J. Horne read a paper on "Alternating-Currents as Applied to Electrical Traction," taking the view that the alternating-current motor would not displace the direct-current motor, but that it would create a field of its own, such as suburban railway work. Dr. Steinmetz was the author of the paper.

East London.—In the official statement of receipts and expenditure for the municipal year ending February 18th last, on the side of receipts the following items appear:—Electric light revenue, £17,327 18s.; electric tramway revenue, £15,391. On the expenditure side, the biggest items under the heading "Electric" are the following:—Light maintenance, £14,579 17s. 6d.; esplanade extension, £6,831 14s. 10d.; power station, additional plant, £3,935 17s. 8d.; new cars, £5,281 13s. 9d.

Gas.—On July 27th Mrs. Sarah Hughes, 82, widow, 35, Hamilton Street, Birkenhead, died from suffocation by gas.

Annual Outings.—The staffs of the Windsor Electrical Installation Co. and of the Slough and Datchet Electric Supply Co. had their annual river trip on Tuesday last week, when they visited Hampton Court by steam launch. Luncheon was served on board under the chairmanship of Mr. A. E. Farrow.

Cricket.—On 26th ult. a cricket match was played at Birmingham between the Dudley and Stourbridge Tramways A. and C.C. and the Birmingham and Midlands Tramways A. and C.C., which resulted in a heavy defeat for the visitors. Score, 70—206. For the winners, G. D. Vickers, of the power house staff, hit up a capital 87. About £10, the proceeds of the match, was handed over to the West Bromwich Albion Football Club Fund.

On Saturday last the Robertson Electric Lamps Cricket Club met Messrs. Drake & Gorham on their own ground at St. Quintins, and, after a very even game, Robertson's won by 3 runs. It was a very exciting finish, Drake & Gorham only having one wicket down for 42 runs, being all out for 53. For the Lamp Works, Ralph took 3 wickets for 18; Whyatt 2 for nothing.

Electric Shock Fatality.—"Accidental Electrocution" was the verdict returned in the inquest on Michael Nae, miner at the Geduld, Boksburg. Deceased was working at a pump down the mine, and was in the wire-protecting-box, when his foot touched the live wire which carried the electric power to the pump.

Appointments Vacant.—Lecturer in electrical engineering (£150) for the Heriot-Watt College, Edinburgh; chief instructor in mathematics (£150) for the Northampton Institute.

Curtis Turbine Test.—A test was recently made on a 2,000-kw. 900 r.p.m. Curtis turbine (built by the General Electric Company, of America) at Schenectady, by Mr. F. Sargent, of Sargent & Lundy, engineers, Chicago, and Mr. Lewis A. Ferguson, Vice-President of the Commonwealth Electric Co., the results of which, it is claimed, substantiate the claims made for this type of turbine, namely, high steam economy coupled with simple and strong mechanical construction. The details were as follows:—

	Full load.	Half load.	Quarter load.	No load.
Duration of test, hours	1·25	0·916	1	1·33
Steam pressure (gauge) lb. per sq. in.	166·3	170·2	155·5	154·5
Back pressure (absolute) in. of mercury	1·49	1·40	1·45	1·85
Superheat, degrees F.	207	120	204	156
Load in kilowatts	2,023·7	1,096·7	555	—
Steam consumption per kw.-hour, lb.	15·02	16·31	18·09	1,510·5 per hour

Bradford Refuse Destructor.—We have received a copy of the test carried out on the refuse destructor at Sunbridge Works, Bradford, by Mr. W. N. Binny. The destructor is of the Horsfall type, and consists of 12 cells. The total grate area is 360 sq. ft., and the heat from the cells is given up to two "Marine" type B. & W. boilers, having a heating surface of 2,393 sq. ft. each, and designed for a working pressure of 160 lb. per sq. in. After leaving the boilers, the gases pass through an economiser, in which the feed-water is heated. According to the report before us, the test was carried out from March 15th to the 22nd inclusive, *day and night continuously under the personal supervision of the engineer* and one of the makers' representatives. The steam produced by the boilers was measured by two "Kennedy" water-meters, which were checked by means of two large tanks cabibrated by a standard gallon measure. The temperature of the feed-water was taken at the entrance to the economiser, the latter being considered as part of the boilers. The temperatures of the furnaces and flues were taken by means of melting standard metals, and also by means of a pyrometer. The steam generated was used by an electric light plant, whose output was absorbed by a water resistance, the energy being measured by means of an electricity meter. The average air pressure under the grates was 1 in. w.g., the forced draught being supplied by steam-jet blowers. The total quantity of refuse burned per cell for 24 hours was 9 tons 18 cwt. 1 qr., which averaged 6·6 tons per man per shift. The total quantity burned through the test was 832 tons 16 cwt. 3 qrs., and the weight of clinker and ash was 421 tons, or about 50 per cent. of the weight of refuse put into the furnaces. The results of the test show an evaporation of 1·25 lb. of steam from and at 212° F. per lb. of refuse. The total steam generated in the boilers per hour was 13,042 lb., of which 2,283 lb. per hour was used by steam-jets for forced draught, feed-pump, economiser and leakage; of this amount 1,003 lb. was due to the last three items, the difference, namely, 1,280 lb. of steam per hour, being the amount used for working the forced draught.

Tramway Accident Compensation Case.—On Wednesday the claim was heard of Dr. White, of Bradford, against the Bradford Corporation for £16,000, for loss of practice caused by personal injuries sustained through a tramcar colliding with his phaeton. The jury awarded plaintiff £1,500.

The N. T. Co. and the Telephone Agreement.—The *Daily Telegraph* understands that strong objection has been taken by the National Telephone Co. to the modifications recommended by the Select Committee to the agreement with the Postmaster-General on the subject of municipal telephones. The company have informed the Postmaster-General that, as at present advised, they are not disposed to accept a modification in the terms of the agreement which they consider to be prejudicial to their interests.

Electric Power in Canada.—Evidently it is the intention of the Government of the Province of Ontario to make a thorough inquiry into the question of power development, the cost, possibilities, &c., for it has appointed a commission to be known as the Hydro-Electric Power Commission, which body is composed of Hon. Adam Beck, London, Ontario; Mr. George Pattinson, M.P.P., Prescott, Ontario; and Mr. P. W. Ellis, of Toronto. Mr. Beck has been selected as chairman; and Mr. Cecil B. Smith is to be engineer to the Commission. The Order in Council giving the Commission instructions for its labours, reads as follows:—

"The present and probable demand for hydraulic and electric power in the various districts capable of being supplied from the different water powers within the legislative jurisdiction of the Province of Ontario.

"The location, capacity and capital cost of development of the various water powers within the legislative jurisdiction of the Province of Ontario at present undeveloped, but whose development is required to supply the present and probable needs of the surrounding district, and to ascertain the probable cost of the attendant transmission plants necessary to the utilisation of electric or hydraulic power to be derived from the aforesaid water powers within the respective surrounding districts.

"To ascertain the rates or prices that would require to be charged, the various classes of consumers of hydraulic or electrical power within the respective districts in order to meet all expenditure of maintenance and operation.

"To inquire into and ascertain the annual savings accruing to the consumers in the various districts aforesaid by the substitution of the rates or prices to be ascertained under the next preceding paragraph, for the rates paid at present in the said districts, so far as the commissioners may be able to ascertain or estimate them.

"To inquire into and ascertain the cash capital cost of the hydraulic and electrical power undertakings of existing companies located within the province of Ontario; the capacity and state of development thereof, and to ascertain further:—

"(*a*) The quantities of power supplied and contracted for, and the rates charged, and to be charged, under such contracts by these companies for hydraulic or electric power.

"(*b*) The actual present value of the said undertakings, after making such fair and reasonable allowance for existing conditions as in the judgement of the Commissioners seems necessary or expedient.

"(*c*) The estimated capital outlay, if any, necessary to complete these undertakings."

Electrolytic Assaying.—A paper by Mr. F. B. Stephens, recently read before the Institute of Mining and Metallurgy, on the "Treatment of Refractory Auriferous Sulphides at the Cassilis Mine, Victoria," contains an interesting account of the method employed of assaying the solutions used in the cyanide process. The solutions to be assayed are electrolysed for a period of four hours, the gold being precipitated on a cathode of lead foil, and the anode consisting of a wrought-iron rod. The formation of prussian blue on the anode is prevented by the addition of an excess of ammonia, and the necessary circulation of the solution is caused by the liberated gas bubbles and the peculiar shape of the cathode. The precipitation of gold is very complete. On solutions assaying 10-15 dwt. of gold per ton, and containing ·03 to ·25 per cent. of cyanide, the value is reduced to below 3 gr. in four hours with the necessary current density. As compared with evaporation, the results are more consistent. In practice, 10 assay tons—212 cc.—of solution are taken in a tall beaker, and 12-15 cc. of strong ammonia added. The lead cathode consists of a cylinder of lead foil 2½ in. high and 1 in. in diameter, with three V-shaped notches cut in the lower rim, a lead strip being attached at the top with which to make connection. The lead foil cylinder should be covered to a depth of about ½ in. A 6-in. nail is used as an anode. The disengaged gas bubbles cause an upward current in the solution inside the cylinder, and down round the outside, and through the V notches in the bottom. It is usual to make from 14 to 20 assays at one time, all joined in series between the terminals of 110-volt lighting mains. With 20 assays in series, no extra resistance is necessary, but with a lesser number than 14, incandescent lamps are inserted. The current used is from ·06 to 1·2 amperes; the fouler the solution, the higher the current density that can be safely used. The gold comes down as a bright yellow deposit, and when precipitation is complete the cathode is washed in water, dried, rolled up, scorified with the addition of some test lead, and cupelled.

The Dangers of "Electrolytic Oxygen."—Last spring a fatal explosion of a cylinder, nominally charged with compressed oxygen, occurred in the physical laboratory of the Technical Institute of Winterthur, in Switzerland. One man was killed, several lads hurt, and the building damaged. It is now stated by the *Chemiker-Zeitung* that the gas in question was made by electrolysing water, and that the cylinder (in some way which is not explained) had sufficient hydrogen in it at the time of the accident te render its contents most explosive. The episode has naturally attracted a good deal of attention, and has enabled the makers of oxygen by non-electrical methods to point out the purity of their products.

Magnetic Properties of Alloys of Nickel and Cobalt with Iron.—According to W. Guertler and G. Tammann, when mixtures of cobalt with nickel, cobalt with iron, and nickel with iron are prepared by fusion and then cooled, the crystals which are obtained have the same composition as the fused mixture. These crystals are not magnetic, but become so on further cooling. If curves are drawn showing the relationship between the composition of the crystals and the temperatures at which they become magnetic, the Co-Ni curve is continuous, the Ni-Fe curve exhibits one break, and the Co-Fe curve three breaks. With one exception, no change in the composition of the crystals appears to occur when they alter into the magnetic condition.

The Dangers of Lightning.—According to the *Statistische Correspondenz*, the danger of lightning regarded from the number of objects struck fluctuates extraordinarily from year to year. The years when thunderstorms are numerous differ materially from other periods in the sense that the danger surprisingly increases, but these years are followed by others when the danger is much less. These points are illustrated by the following table in relation to Germany:—

Years of slight danger.	Years of considerable danger.
1881-1883	1884-1886
1887-1888	1889-1891
1892-1894	1895-1896
1897-1898	1899-1900
1901-1903	—

It is pointed out that the lightning "strikes" which did not cause any fires show an astonishing increase, although this is mainly attributed to more exact reporting of the results. In the case of lightning "strikes" which caused fires, the following position is revealed for the German country districts and for towns in regard to both light and heavy years of thunderstorms:—

Slightly dangerous years.	No. of cases in country districts.	No. of cases in towns.
1887-1888	1,470	222
1902-1903	1,451	186
Dangerous years.	**No. of cases in country districts.**	**No. of cases in towns.**
1885-1886	2,175	283
1899-1900	2,592	393

As to the material damage produced by lightning, it has been ascertained that the destructive effects represented £499,500 in the years 1885 and 1886 and £306,500 in 1887 and 1888. The greatest amount for individual years was £325,000 in 1895 and £328,500 in 1900, and the flat land in the country suffers the most from damages caused in the manner indicated.

OUR PERSONAL COLUMN.

[*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*]

Central Station Engineers.—On July 30th, at St. Mary's Church, Lewisham, Mr. James P. Dell, charge engineer to the L.C.C. tramways, was married to Louise Maud, fourth daughter of the late Mr. W. Lusby, of Lewisham. Among the presents, which were numerous and useful, was an épergne, given by the staff of the sub-stations. The honeymoon is being spent at Bournemouth.

Mr. H. A. Harding, of the Leatherhead Electricity Supply Co., has been appointed assistant electrical engineer to the Acton U.D.C. There were 114 applications for the appointment.

Mr. W. A. Jackson has been appointed chief engineer and manager of the West Bromwich Corporation Electricity Works at £300 per annum. He is at present under the Manchester Corporation Electricity Department, and was previously with the Corporations of Sheffield and Birmingham.

The Gloucester T.C. on July 26th referred back to the Electricity Supply Committee for further consideration a recommendation that the salary of Mr. Bache, city electrical engineer, should be increased from £300 to £325 per annum, with an increment of £25 a year for two years.

The Dover T.C. has appointed Mr. H. E. Osborne as shift engineer at the E.L. works.

Mr. S. Poole, of the Grantham and Stamford electricity works staff, has been appointed assistant engineer at the Salisbury electric light works.

Tramway Officials.—Bolton Tramways Committee has increased the salary of Mr. F. Taylor, assistant engineer, by £20 per annum.

General.—A hundred friends of Mr. W. S. Doran assembled last Thursday night at the Hotel Cecil to give him a farewell dinner previous to his departure for the United States, where he intends to take up his residence. Mr. Doran was formerly with the Worthington Pump Co., but has been associated for the last few years with the Westinghouse interests in this country. His genial manner has gained him many friends.

Mr. Walter Phillips, having opened at Marken Buildings, Apollo Street, Bombay, a consulting electrical engineer's practice, invites firms interested to forward catalogues, drawings, or samples of specialities in lighting and lift work.

According to the *Times* a party of about 150 members of the British Association left Southampton in the *Saxon* for Cape Town on Saturday last. They included Prof. G. H. Darwin, President-Elect, Sir William Crookes, Sir Benjamin Baker, Mr. Alex. Siemens, Profs. Vernon Boys, H. S. Carhart, J. Milne and J. Perry.

Mr. Luigi Vanoni has been appointed Director of Telegraphs of Switzerland.

On July 27th at the National Telephone Co.'s electrical department at Aberdeen, Mr. Fred Harrison was presented by his colleagues on the electrical staff of the company with a timepiece and ornaments and a rug on the occasion of his marriage.

In the list of successful candidates for the degree of B.Sc. in Engineering of London University, we note the name of Mr. A. S. E. Ackermann, A.M.Inst.C.E.

A Jamaica paper says that Mr. L. Foster Davis, manager of the Electric Light and Power Co., took charge at the office of the West India Electric Co. early in July as manager of the amalgamated business.

On Wednesday evening, 2nd inst., at the Imperial Restaurant, Glasgow, Mr. A. Ferguson (of Kelvin & James White, Ltd.) was made the recipient of a handsome case of drawing instruments, as a token of respect from the staff, on the occasion of his severing his connection with the firm.

NEW COMPANIES REGISTERED.

De Forest Wireless Telegraph Syndicate, Ltd. (85,277).—This company was registered on July 18th, with a capital of £120,000 in £1 shares, to adopt an agreement with S. S. Bojesen, and to carry on the business of owners of wireless and other telegraph systems, patents and concessions, &c. The first subscribers (each with one share) are:—Lord Armstrong, 93, Eaton Square, S.W.; A. M. Grenfell, 6, Princes Street, E.C., gentleman; S. S. Bojesen, Great Swan Alley, E.C., gentleman; N. Maskelyne, 17, Elgin Crescent, W., electrical engineer; H. Malpas, 43, Iverna Court, Kensington High Street, W., gentleman; A. H. Leslie, Wynberg, Broomwater, Teddington, gentleman; and G. Harland, 43, St. Mary Axe, E.C., shipbroker. No initial public issue. The number of directors is not to be less than three nor more than nine. The subscribers are to appoint the first; qualification, £250; remuneration, £200 each per annum (chairman £100 extra), and an additional £50 each for every 1 per cent. dividend in excess of 10 per cent.

Para Electric Railways and Lighting Co., Ltd. (85,368).—This company was registered on July 25th, with a capital of £700,000 in £5 shares (70,000 preference), to acquire from the Works Construction Co., Ltd., the existing tramway and electric lighting undertakings with the Companhia de Estrada de Ferro Paraense, of Para, and a provisional concession of January 27th, 1905, granted to C. H. C. Moeller by the Municipality of Para, to construct or acquire and work tramways, railways and electric lighting and power supply works and undertakings in Para or elsewhere in Brazil, &c. The Works Construction Co., Ltd., are the promoters of this company, and will re-sell the said undertakings and concession at a profit, having acquired from J. G. White and Co., Ltd., an option to purchase the same granted to them by the said Companhia de Estrada de Ferro Paraense, of Para, and C. H. C. Moeller. The company is to enter into an agreement with the Works Construction Co., Ltd, for the execution by that company of all necessary works for the reconstruction and adaptation for electric traction of the said tramway system, and for the development and extension of the tramway and electric light and power business of the company. The first subscribers (each with one share) are:—H. Ansell, 75, Lombard Street, E.C., actuary; F. S. Baring-Gould, 30, Denman Street, S.E., managing director of public company; W. W. Paine, 14, St. Helen's Place, E.C., solicitor; W. K. Whigham, 2, Princes Street, E.C., chartered accountant; H. P. Dakin, 130, Holmesdale Road, South Norwood, S.E., clerk; W. J. Hill, 14, St. Helen's Place, E.C., solicitor; and A. E. Bullard, Burleigh, Chudleigh Road, Brookley Grove, S.E., clerk. No initial public issue. The directors may not issue debentures or debenture stock in excess of £700,000, nor any debentures or debenture stock bearing more than 5 per cent. interest, without the consent of the holders of the preference shares, Nos. 70,001 to 115,000, and may not exceed the said sum of £700,000 by more than £300,000 without the sanction of a general meeting. The number of directors is not to be less than three nor more than seven, of whom one shall be appointed by the holders of the said preference shares. The remaining first directors are to be appointed by the subscribers. The Companhia de Estrada de Ferro Parsense, of Para, is to make the first appointment on behalf of the said preference shareholders. Directors' remuneration, £400 per annum for the chairman, and £200 each for the others. Registered office, 75, Lombard Street, E.C.

Bombay Hyrdo-Electric Syndicate, Ltd. (85,378).—This company was registered on July 26th, with a capital of £15,000 in £10 shares, to adopt an agreement between D. J. Tata and E. Miller on behalf of themselves and also on behalf of R. J. Tata, J. W. Brown and D. E. Gostling, to produce, generate, accumulate, store, acquire, utilise, supply, apply, employ, distribute, sell, lease or otherwise dispose of electric current, power and energy, and to carry on the business of engineers or contractors in all its branches. The first subscribers (each with one share) are:—E. T. Washington, 32, North Road, New Cross, S.E., clerk; J. F. Cooke, 13, Arngask Road, Catford, S.E., clerk; F. C. Booker, 35, Bristol Gardens, Paddington, W., clerk; W. H. Fay, 14, Seymour Place, Fulham Road, S.W., clerk; P. A. Hall, Wenderholme, 31, Merton Hall Road, Wimbledon, clerk; W. H. Werner, 15, Chadwick Road, Leytonstone, book-keeper; and P. Gibbs, 30, Hemberton Road, Clapham, S.W., clerk. No initial public issue. The number of directors is not to be less than three nor more five; the subscribers are to appoint the first; qualification, £500; remuneration as fixed by the company.

Buenos Aires Port and City Tramways, Ltd. (85,427).—This company was registered on July 29th, with capital of £200,000 in £5 shares, to construct, lay down, equip, work and maintain tramways in the Argentine Republic, and particularly in the Port and City of Buenos Aires, to acquire running or other powers, rights and easements over or interests in any other tramways, telegraph and telephone systems, &c., to adopt agreements (1) with B.A.P. Syndicate, Ltd., and (2) with F. W. Lowther (trading as "Lowther and Co."), and to carry on the business of owners of electrical, steam, horse or other tramways, electricians, engineers, suppliers of electricity for light, heat, motive power and other purposes, manufacturers of and dealers in rolling stock and vehicles, carriers of passengers and goods, &c. The first agreement above referred to provides for the acquisition of a concession for the construction and working of a tramway in Buenos Aires, granted to E. B. Gandulfo & Co. The said syndicate is to receive 26,000 fully paid ordinary shares in this company, and is to procure the company to enter into the next mentioned agreement, the syndicate, for £11,900 in cash, guaranteeing the subscription of the whole of the £200,000 debenture stock mentioned below, if offered to the public. The agreement with F. W. Lowther is for the construction and equipment of the tramway and works, and for providing the company with £26,900 for working capital and other purposes, the consideration being 13,131 fully paid ordinary shares, and £200,000 6 per cent. debenture stock of the company, or the proceeds of such debenture stock as in the contract mentioned. E. B. Gandulfo & Co. originally entered into an agreement with the Government and General Contract Co., Ltd., for the sale of the concession to that company, but afterwards, with the concurrence of the said Contract Co., entered into the agreement for the sale of the said concession to Lowther & Co., and the last-named firm subsequently agreed to sell the concession to the B.A.P. Syndicate, Ltd. The first subscribers (each with one share) are:—H. S. Lamb, 5, Connaught Road, Harlesden, N.W., manager; T. G. H. Wilmot, 46, Loraine Mansions, N., clerk; A. E. Wallace, Glenthorne, Worple Road, Epsom, secretary; G. S. Keeble, 27, Soames Street, Denmark Park, S.E., engineer's assistant; F. Surman, 120, Tollington Road, Holloway, N., clerk; H. Spinks, 63, Roding Road, N.E., clerk; and I. H. Chapman, 78, Algernon Road, Lewisham, S.E., clerk. Minimum cash subscription 20 per cent. of the shares offered to the public. The number of directors is not to be less than three nor more than seven; the first are G. Kitchin, M. Graham, M.I.C.E., J. Kerr, M.P., and A. Wenham; qualification, £500; remuneration, £1,500 per annum and 10 per cent. of the surplus profits remaining after 7 per cent. dividend has been paid, divisible. The directors' borrowing powers are limited to the amount of the issued capital for the time being. Registered office, 2, Broad Street Place, E.C.

Switchgear Co., Ltd. (85,405).—This company was registered on July 27th, with a capital of £10,000 in £1 shares (5,000 preference) to adopt an agreement with J. G. Statter & Co., and to carry on the business of suppliers of electricity in all its branches, electrical and mechanical engineers, manufacturers of and dealers in electric, magnetic, telegraphic, telephonic and other appliances and apparatus, &c. The first subscribers (each with one share) are:—J. G. Statter, Cornwall Buildings, Newhall Street, Birmingham, civil engineer; E. A. M. Bindloss, Cornwall Buildings, Newhall Street, Birmingham, civil engineer; C. J. Simeon, Cornwall Buildings, Newhall Street, Birmingham, civil engineer; M. N. Phelps, 19, Newhall Street, Birmingham, solicitor; W. J. Wold, 71, Suffolk Street, Birmingham, clerk; C. R. Gadsen, 18, Haverhill Road, Balham, S.W., clerk; and J. J. Watson, New River Yard, Clerkenwell, E.C., clerk. No initial public issue. The number of directors is not to be less than three nor more than five; the first are J. G. Statter and E. A. M. Bindloss (both permanent) and C. J. Simeon; remuneration, 25 guineas each per annum. Registered office, Cornwall Buildings, Newhall Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Potteries Electric Traction Co., Ltd. (57,968.)—This company's annual return was filed on June 16th, when 24,499 ordinary and 24,500 preference shares had been taken up out of the nominal capital of £600,000 in 30,000 ordinary and 30,000 preference shares of £10 each. £10 per share has been called up on 17,833 ordinary and 24,500 preference, and £423,330 has been received. £66,660 is considered as paid on 6,666 ordinary shares. Mortgages and charges: £245,000.

Peterborough Electric Traction Co., Ltd. (74,562).—This company's annual return was filed on June 9th, when 4,000 preference and 4,000 ordinary shares had been taken up out of the nominal capital of £60,000 in 6,000 ordinary and 6,000 preference shares of £5 each. £5 per share has been called up, and £40,000 has been received. Mortgages and charges: £20,000.

Siemens Bros. & Co., Ltd. (14,777).—This company's annual return was filed on June 9th, when the entire capital of £600,000 in 120,000 shares of £5 each had been taken up and paid in full. Mortgages and charges: £150,000.

West India and Panama Telegraph Co., Ltd. (11,116).—This company's annual return was filed on June 14th, when 127,553 shares had been taken up out of a nominal capital of £2,445,630, in 244,563 shares of £10 each. £1,275,530 is considered as paid. Mortgages and charges: £80,000.

West African Telegraph Co., Ltd. (21,620).—This company's annual return was filed on June 19th, when 23,109 shares had been taken up out of a nominal capital of £400,000, in 40,000 shares of £10 each, and paid for in full. Mortgages and charges: Nil.

Spanish Telephone Co., Ltd. (41,589).—This company's annual return was filed on July 6th, when 1,600 ordinary and 549 preference shares had been taken up out of a nominal capital of £41,000, in 1,600 ordinary shares of £10 each and 1,250 shares of £20 each. £20 per share has been called up on 549 preference, and £10,980 has been received; £16,000 is considered as paid on 1,600 ordinary. Mortgages and charges: Nil.

Tyer & Co., Ltd. (56,760).—This company's annual return was filed on July 17th, when 22,007 shares had been taken up out of a nominal capital of £25,000 in £1 shares. £2,000 has been received, leaving £7 in arrears, and £20,000 is considered as paid. Mortgages and charges: Nil.

Auckland Electric Tramways Co., Ltd. (61,199).—This company's annual return was filed on May 25th, when the entire capital of £300,000 in 30,000 shares of £10 each had been taken up. £10 per share has been called up on 28,510, and £285,100 has been received. £14,900 is considered as paid on the remaining 1,490. Mortgages and charges: £285,100.

Sherardising Syndicate, Ltd. (London). (73,024).—Issue on June 27th of £210 debentures, part of series created February 27th, 1905, to secure £1,100, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £890.

Kent Electric Power Syndicate, Ltd. (72,742).—A mortgage or charge on the company's undertaking and property, present and future, including uncalled and unpaid capital (if any), dated July 3rd, 1905, to secure £750, has been registered. Holders: The Hon. J. B. Lubbock and G. C. Curtis, 15, Lombard Street, E.C.

Callender's Cable and Construction Co., Ltd. (48,915).—This company's annual return was filed on July 5th, when 35,000 ordinary and 40,000 preference shares had been taken up out of a nominal capital of £500,000 in 60,000 ordinary and 40,000 preference shares of £5 each; £5 per share has been called up on 55,000, and £275,000 has been received; £160,000 is considered as paid on the remaining 20,000 shares. Mortgages and charges: £300,000.

China and Japan Telephone and Electric Co., Ltd. (17,831).—This company's annual return was filed on June 14th, when 14,761 shares had been taken up out of a nominal capital of £20,000 in £1 shares, and £14,761 was considered as paid. Mortgages and charges: £5,000.

United Electric Tramways of Monte Video, Ltd. (80,456).—A trust deed dated July 12th, 1905, to secure £500,000 debenture stock, created October 28th, 1904, has been registered. Property charged: 90 debentures of $4,700 gold each and 560 fully paid shares of $1,000 gold each in La Sociedad Comercial de Monte Video, any debt that may be incurred by the said company to this company in respect of moneys advanced to them out of the proceeds of the debenture stock of this company issued or to be issued in accordance with the terms of the said trust deed, &c. Trustees: Major W. E. E. Gordon, M.P., 4, Chelsea Embankment, S.W.; Hon. C. G. Hay, M.P., Basildon House, Moorgate Street, E.C.; and H. A. Trotter, 7, Mincing Lane, E.C.

New General Traction Co., Ltd. (47,321).—Particulars of a series of £18,700 debentures, created by resolution of February 8th, 1905, and having the benefit of a trust deed of June 28th, 1901, have been filed pursuant to Sec. 14 (4) of the Companies' Act 1900. In certain events a bonus of 5 per cent. is secured to the debenture holders in addition to the principal moneys. Property charged: 19,070 fully-paid £10 shares in the Norwich Electric Tramways Co., 10,267 fully-paid £10 shares in the Coventry Electric Tramways Co., 12,262 fully-paid £1 preference shares in the Douglas Southern Electric Tramways, Ltd., and (by way of floating security) the company's general assets, present and future. Trustees: Captain F. Pavy, Foley House, Portland Place, London; and Baron D'Erlanger, 20, Bishopsgate Street Within, E.C.

Cryselco, Ltd., electric lamp manufacturers, London (58,218).—Issue on June 26th of £600 first and £4,100 debentures, parts of two series created June 26th, 1905, to secure £5,000 each, charged on the company's undertaking and property, present and future, including uncalled capital and certain land and premises at Kempston, Beds. Previously issued of same series, £3,000. A trust deed dated July 11th, covering both the above mentioned series, has also been registered. Trustees: A. Baker, Billiter House, Billiter Street, E.C.; and H. S. Deacon, Kempston, Bedford.

Bogota Telephone Co., Ltd., (69,059).—£15,000 debentures created March 2nd, and dated July 11th, 1905, have been registered. Property charged: Land and buildings in Bogota and the company's concessions, rights, privileges, plant, and other assets, present and future, including uncalled capital. Trustees, under deed of May 29th, 1905: R. A. Danvers, 13 and 14, Abchurch Lane, E.C.; and S. H. Jenks, Barrow Hedges, Carshalton, Surrey.

Frank Suter & Co., Ltd., electrical engineers, London (57,193).—A memorandum of satisfaction to the extent of £1,000 of debentures dated April 18th, 1901, securing £7,000, has been filed.

Electric and General Investment Co., Ltd. (31,506).—This company's annual return was filed on July 26th, when the entire capital of £200,000 in 20,000 ordinary, 100 founders' and 19,900 preference shares of £5 each had been taken up. £1 per share has been called up on the ordinary and £5 per share on the founders' and preference, and £120,000 has been received. Mortgages and charges: Nil.

Evershed & Vignoles, Ltd. (43,206).—This company's annual return was filed on July 19th, when 2,700 shares had been taken up and paid for in full out of the nominal capital of £30,000 in 3,000 shares of £10 each. Mortgages and charges: £14,000.

North Wales Power and Traction Co., Ltd. (78,193).—A memorandum of satisfaction in full of charge dated May 4th, 1905, securing £135,000 debenture stock, has been filed.

CITY NOTES.

Crompton & Co.

The seventeenth annual meeting of this company was held on Thursday last week at Salisbury House, Mr. J. Trotter in the chair.

The Chairman, in proposing the adoption of the report, said it was a very unpleasant task to have to put before them such an exceedingly disappointing report. Last year he indicated to them the condition of things which prevailed in the electrical engineering trade, and he could only repeat that they remained as they were. The position of things in the trade generally was exceedingly unsatisfactory. The production was beyond the demand, and the result was that prices had fallen to a level which was unremunerative, and buyers generally, and those who sent tenders for contracts, had it entirely their own way. In the contract portion of the business they had to incur vast expense in getting out tenders, and as there were a large number of tenderers and only one could get the contract, it followed that a very heavy expense fell upon those who tendered and were unsuccessful. Notwithstanding the low prices that had ruled where reasonable contracts had been secured, there had been a fair and reasonable profit on them. Indeed, had it not been for the contracting side of the business, which had been satisfactory, the year's trading would have been even worse than it had. The manufacturing side of the business had been most disappointing. Prices were at a low ebb, and wages, material and expenses generally, had not fallen in proportion, and the consequence was that the gross profits of the manufacturing business had been most disappointing, and that had been the cause of the exceedingly unsatisfactory result of the year. The directors had to face the question of whether they should, under the circumstances, entirely pass the dividend, or whether they should openly take from the reserve an amount which would enable them to pay some small dividend. In coming to a decision on the matter, they had been influenced by certain considerations which were not quite apparent on the surface. There had been a change of fashion in the goods which were required, and the result had been that there was a tendency towards alternating motors. They had had to follow that, and he hoped they had done it with complete success as far as practical results were concerned; but to do it they had had to spend a very large sum of money, the whole of which had been charged to the year's work. Had it been possible to accurately figure out what those expenses had amounted to, it would have been a perfectly legitimate thing to have carried them forward to a suspense account, to be written off future profits. However, they had thought it best not to create a suspense account, but instead to use some of the profits which had been put by in prosperous years to assist in paying a small dividend. As to the future, he was glad to say that they had made construction contracts with the Electric Supply Corporation on terms which should undoubtedly result in satisfactory profits. The contracts were based upon a fixed profit to cost, and therefore they must secure a profit when the works were completed.

Mr. B. Gibson seconded the motion, and the report was adopted.

Lisbon Electric Tramways, Ltd.

The meeting of this company was held on 26th ult., Mr. Ludwig Breitmeyer presiding. In moving the adoption of the report, he said they had had a successful year. Comparing the year under review with the previous one, they had carried 3,000,000 more passengers, their cars had covered some 700,000 more car-miles, and yet the cost of running the power house remained at the same figure as before. The profit for the year, before allowing for depreciation and before the payment of £25,000 for debenture interest, amounted to £99,000, as against £91,000 in 1903. The growth of their business necessitated an increase in the power plant by adding another unit, and they had also had to construct three new extensions equal to 4 kilometres single track. During this year they had under construction still larger works for new extensions, also additions to the rolling stock, and many other improvements necessitated by the great development of Lisbon. The

results achieved during the first six months this year were so encouraging as to justify his predicting a record for this year. Since the original programme was finished, about 13 kilometres of new lines had been added. The expenditure required for these new works had so far been borrowed, and financed out of the reserve accounts, and no fresh capital had been issued. The question of refunding in cash the sums borrowed from the reserve accounts would be considered at a later date. The usual necessary provision of £20,000 for depreciation had been set aside, bringing the depreciation account to £40,000. Besides this, the directors had considered it advisable to create a special reserve accident account, and a reserve account against the fluctuations of the exchange, with £10,000 and £5,000 respectively. After providing these sums and paying the 6 per cent. dividend on the preference shares, the balance on hand amounted to £17,197, which sum it was proposed to carry forward to next year's accounts. The directors considered that a conservative policy should be followed in the distribution of profits. The intrinsic value of the ordinary shares, as well as the other stock of the company, was enhanced by this conservative policy.

The report was adopted.

A resolution was subsequently passed, removing Mr. A. Parrish from the board of the company.

Great Northern and City Railway Co.

The report for the half-year ended June 30th last states that the total revenue receipts for the six months amounted to £46,239, as against £36,509 for the previous six months. The passengers carried for the same periods, excluding season ticket-holders, were 6,391,574 and 5,227,595 respectively. The number of local season tickets issued during the half-year was 2,913, as against 2,511 for the half-year ended December 31st, 1904. The number of three-route season ticket-holders using the company's line during the past half-year was 2,547. The number of through bookings from the company's stations over the Great Northern and the City and South London Railways is steadily increasing.

City and South London Railway Co.

Mr. C. G. Mott presided on Tuesday at the half-yearly meeting, and regretted that they had again to recommend a reduced dividend. They had done all that could be done to meet the various adverse influences that had been at work. In regard to future capital that might be required they proposed to raise it by the issue of preference and debenture stocks. They would have abundant capital for all that they required when it was placed, and they hoped to get good premiums for that stock which would go far to reduce the discount on the issue of ordinary stock. The revenue receipts had shown a decrease in passengers of 564,399, and in money £4,677. The total decrease in receipts was £4,031. The expenditure had been decreased thus:—maintenance by £147, locomotive generating power £585, carriage repairs £146, traffic expenses £557, and several small items. There were certain increases also which made the total net decrease £1,436. After payment of debenture and preference interest a 2 per cent. dividend absorbed £14,800, and £1,041 was carried forward. The reduced expenditure was due partly to a reduction in the train miles. They had run only 539,000 against 589,000 in the corresponding half of 1904. The total passengers were 8,662,000, against 9,226,000. The passengers per train had increased from 95 to 98. The receipts per train had been 16s. 3·7d., against 16s. 8d., and per train mile 2s. 7·9d., against 2s. 7·3d., and per passenger 1·84d., against 1·85d. The working expenses had been 46·1 per cent., against 45·6 per cent., a very slight increase. The expenses per train mile had been 1s. 3·6d., against 1s. 2·9d. Locomotive charges were 4·79d., against 4·58d., and traffic expenses 6·8d., instead of 6·5d., and the number of trains run had been 88,056, against 96,229. All this showed great care on the part of the officers in the working of the line. They had carefully economised wherever possible without interfering with the traffic. The question of what was going to happen in the future had received very much attention. They had been going down in their dividend for several years. Was that going to continue or were they to look forward to the future of the line? They had gone into all the details of that question. The L.C.C. electric tramways competition had been for short-distance fares, ½d. and 1d. They had done their worst and had practically annihilated this company's 1d. fares on that part of the line. The Council could not do any more, that was one comfort. The company had their long-distance traffic left, which was after all the great bulk of their traffic and could not be touched by the trams. The weather had also been against the company very much of late, but in this country that was not likely to continue long. The other question was the motor-omnibus from which he thought they had not much to fear. In many cases they would bring this company traffic. They had evidently got to look in the future to their long-distance traffic and to cultivate that in every way. They had found that the reduction in fares had not produced a satisfactory result. They had not lost anything but they had to carry a great many more passengers for nothing. It might be that in the future that reduction would recoup itself, but reduction of fares did not seem to be the direction in which they must look. It was evidently the extension of the line and the long-distance traffic, which they were going to get by the extension of the line to Euston. They had hitherto run through a district which was already built up and completed with houses, so that they found that the traffic became stagnant; it did not continually increase as might be expected. That was because they had tapped the whole of the traffic at once. By the extension to Euston and St. Pancras they were putting themselves into connection with four railways whose suburban element was growing very fast. They would thus get a perpetually growing instead of a stagnant traffic. When that extension was completed they would have a very different story to tell. The time for the completion of the line expired in September next year, and they hoped that it would be opened for traffic in the course of next year. They still believed in the future of their railway, and that before long it would be as good a dividend-paying line as any in the country.

The report was adopted, and the dividend resolution approved.

Baker Street and Waterloo Railway Co.

Mr. T. J. Hare presided at the half-yearly meeting held on Tuesday at Hamilton House. In moving the adoption of the report, he referred to the progress of the works, and said that the running tunnels had now been driven the whole way between Harewood Avenue and Elephant and Castle; between Harewood Avenue and Westminster Bridge Road and the depôt. The permanent way would be completed in about six weeks' time and the conductor rails in October. It was expected that the lift works would be finished by the end of November. The stairways were in use and it would take a month to finish them off. Work in connection with the ventilation would be completed in October. The arrangements for lighting were well in hand, and as soon as the actual installation could be begun it would not take long to carry it out. The high-tension cables would be finished and tested in August. There were three sub-stations. The one at Charing Cross belonging to the District Co., which would be used by this company under agreement, was completed and working. The one at Baker Street was expected to be completed by October 1st, and the one at London Road by the end of November. At the car depôt all the buildings were completed, and most of the machinery was in position. All of the sidings will be completed by the end of August, and several of them were ready for use. The rolling stock was not ready so soon as they expected, as some was to be delivered in May. However, the first cars should be delivered next month. The motors and control equipments for the whole of the rolling stock had been delivered. The superstructures at the station were being built as fast as possible, and between Baker Street and Westminster Bridge Road they should be all completed by December 1st. It was hoped that the line between the Elephant and Castle and Baker Street would have been opened before the end of this year, but there was a very large amount of detail work involved in completing an undertaking of this magnitude, and the contractors feared that it would not be possible to get everything ready for opening for public traffic by then, but they expected that the full service of trains would be running between Westminster Bridge Road and Baker Street early in next year. That would be of enormous advantage to the very large number of people crossing over Westminster Bridge. It was stated in the House of Lords in the recent debate with regard to the extension of tramways over that bridge that the traffic morning and evening alone amounted to 45,000 passengers each way. The company's line would tap at its Elephant and Castle and Westminster Bridge Road stations nearly the whole of the tramway traffic of South London, enabling passengers who were now turned out at Westminster Bridge to go quickly and at a minimum cost to the heart of, and right through the centre of, London. Work on the sections of the line between Westminster Bridge Road and the Elephant and Castle from Harewood Avenue westward was being pushed on as rapidly as possible. The company's Bill was now awaiting Royal Assent. Opportunity would be made in the autumn to enable stockholders to exchange their present stock for bearer debenture stock. The Royal Commission on London Locomotion made no recommendation for new railways likely to be detrimental to this line. It seemed necessary to wait and see the full effect of the Metropolitan and District and the tube railways, as well as the altered conditions to be brought about by motor traffic now only in its infancy; unnecessary duplication of lines and unnecessary expenditure of capital would be thus avoided.

Sir Algernon West seconded the motion, and the report was adopted.

A resolution was passed providing that the future half-yearly meetings may be held on such dates as the directors may determine.

The Electric Supply Corporation.

The third annual meeting of this company was held on Wednesday last week at Salisbury House, Mr. Carleton F. Tufnell presiding.

In proposing the adoption of the report, the Chairman said that since they last met a considerable change had come over the company's affairs. At that time the subscribed capital was £17,000, and he informed them that they had arranged for a further issue of £50,000 share capital. At the close of the year the capital subscribed and issued amounted to 21,492 shares, or in round figures £107,460 plus £50,000 debenture stock. Since the closing of the accounts, negotiations had been carried to a successful issue for the placing of an additional 20,000 shares, or £100,000, which would bring the total capital up to £207,500. That put them in the position to make a further issue of £50,000 debenture stock whenever required. The company was now in a position to push on and complete a great part of the programme mentioned in the prospectus. They had the right and duty of establishing and working electrical undertakings in 17 towns in the United

Kingdom. The brokers with whom they negotiated the issue of debentures suggested that they should acquire the shares in the Chelmsford Electric Lighting Co. At first the board of Messrs. Crompton & Co. demurred to allowing them to have the shares at par, but in the end they acquired the property for an exchange of shares at par. When placing a further issue of 20,000 shares this year, the brokers asked their chief engineer for an estimate of the probable earnings of the company. That was prepared very carefully, with the following result:—In 1905 the estimated earnings would be £3,000; in 1906, £7,200; 1907, £12,900; 1908, £17,000; and in 1909, £19,900, giving a return on the capital expenditure ranging from 1·68 per cent. to 6·05 per cent. in 1909. The brokers thought they would like an independent estimate made by Messrs. Crompton. That had been made, and it was very satisfactory to know that the two independent estimates did not differ very materially. They also asked for some guarantee being given as to the earnings of the company, and Messrs. Crompton had obtained for them the guarantee of a guarantee company that their earnings for the four years—1906-7-8 and 9, should be sufficient, after providing 1 per cent. on the capital expenditure for repairs and renewals to enable the company to pay a dividend for each of those four years, equal to 5 per cent. per annum. At the end of last year they had actually working electric supply stations in five towns, and since that date they had opened stations at St. Andrews and Exmouth, and, of course, they had had the Chelmsford undertaking in full work. The sphere of their operations was a large and increasing one. The number of lamps and motors connected or awaiting connection was equivalent to 35,226 8-c.p. lamps, and they might expect before the end of 1907 that their equivalent of lamps would exceed 100,000 8-c.p. The capital expenditure at the end of the year stood at £123,020, the increase for the year being £43,677. The revenue for the year from the sale of current, dividends, &c., amounted to £2,654, and the working expenses to £1,472, leaving a balance of net profit of £1,182. From that had to be deducted interest on debenture stock, and a small provision for repairs and renewals, leaving a balance of £216 to be carried forward.

Col. Henry Wood, C.B., seconded the motion, and the report was adopted.

Subsequently a special meeting was held, when certain alterations in the articles of association were agreed to for the purpose of enabling the board to get a Stock Exchange quotation for the company's shares.

Waterloo and City Railway Co.

The report for the half-year ended June 30th, 1905, states that the capital account shows a total outlay of £606,551 on June 30th last, being the same amount as at December 31st, 1904. The gross receipts of the line, less Government duty, amounted to the sum of £17,577, and the working expenses to £7,974, being at the rate of 45·37 per cent., as compared with 47·55 per cent. for the corresponding period of 1904. The balance available for dividend, after providing for interest on debenture stock, is £8,758, and a dividend at the rate of 3 per cent. per annum on the ordinary stock will absorb £8,100, leaving £658 to be carried forward. This dividend compares with 3 per cent. for the corresponding period of 1904. The number of passengers carried during the past six months, exclusive of season ticket holders, was 2,219,143, showing a decrease of 8,207 compared with the corresponding period of 1904. The season ticket holders on June 30th last numbered 1,782, as against 1,611 at the end of June, 1904. Several Bills, more or less affecting this railway, have been presented to Parliament. Where necessary, protective clauses have been obtained.

The meeting was held yesterday (Thursday).

Eastern Telegraph Co.

Sir J. Wolfe Barry, K.C.B., presided on Wednesday last week at River Plate House, E.C., over the 66th half-yearly meeting of this company.

In moving the adoption of the report, the Chairman said that when he met the shareholders in January last he stated that the result of the interim half-year's working to September 30th, 1904, might be described as satisfactory, and the results shown by the accounts for the final half-year to March 31st, 1905, which were presented to-day, were even more gratifying to them all. The gross revenue for the half-year under review amounted to £676,000, as compared with (for the corresponding period of 1904) £636,000, or an increase of £40,000. This increase was, however, largely due to additional traffic in connection with the Russo-Japanese War. From August 1st the tariff between Europe and India, and between Great Britain and Aden, would be reduced from 2s. 6d. to 2s. per word. The reduction in the Indian tariff was in accordance with an agreement made with the Secretary of State for India some three years ago, under which a standard revenue was guaranteed. It was then agreed that if three consecutive years produced an average of this standard revenue, the tariff with India should be reduced by 6d. per word. For the three years ended June 30th last the average revenue reached the stipulated figure, and he was pleased to say that during the period in which the tariff had been 2s. 6d. per word the Indian Government had only been called upon to contribute some comparatively small amounts under their guarantee. The increase of traffic with India had been very satisfactory. This was not due, in their opinion, to the reduction of tariff, but to the late general prosperity of the Indian Empire. As a result of the increased traffic the reduction in the rate referred to would be brought into operation on August 1st next. It would be understood that, under the agreement, if the earnings of the associated companies on Indian traffic did not amount at the reduced tariff to the agreed standard revenue figure, the Indian Government would bear a proportion of the difference between the actual receipts and the standard revenue amount. The tariff between Europe and Egypt (1st region) had also been reduced, the reduction being from 1s. 5d. to 1s. per word. With regard to this alteration of tariff, negotiations had been in progress for some time and were completed in April this year. He was glad to say that the various existing agreements between this company and the Egyptian Government had now been consolidated, and an arrangement satisfactory both to the Government and to this company had been concluded, embodying the reduction of the rates to which he had referred and the payment by them of an increased transit rate. They were gratified at being able, with justice to the shareholders, to carry out these reductions, but it must be borne in mind, however, that should the traffics increase largely, they might have to augment their cable capacity. Thus it is obviously advisable to carry as much as possible to the general reserve in view of this and also for other contingencies. The total expenses for the half-year, exclusive of income-tax payable in England and interest on loan, amounted to £232,000, as against, for the corresponding period of 1904, £216,000, or an increase of £16,000. The expenses in London showed a decrease of about £1,300, contributions to staff pension fund £800 (due to a readjustment of the amount payable by the company as the result of the second quinquennial valuation of the fund) and depreciation of spare cable £2,000. The working expenses at stations, the expenses attending maintenance of cables and income-tax payable abroad exceeded the expenditure for the corresponding period to the extent of £7,300, £13,600 and £1,020 respectively. Of the items comprised in the additional expenditure, salaries and wages had increased by £5,400, which was due to the usual annual promotions and to a considerable increase in the number of the staff to deal with enlarged traffics. Maintenance of instruments accounted for £1,200, occasioned by the continuance of their system of adopting new methods and apparatus, after careful experiment and trial by the technical staff, to improve the speed and accuracy of the service. Repairs to buildings, which accounted for an increase of about £1,100, was chiefly due to various alterations to certain of the station buildings. The expenses attending maintenance of cables was necessarily a very fluctuating figure. Many extensive repairs had been carried out during the half-year, and the amount expended on cable was considerably in excess of that for the corresponding period of 1904. The increase under the heading of income-tax payable abroad represented the company's liability under the Act recently introduced into Cape Colony. They had been obliged to pay this tax although urgent representations had been made to the proper quarter, with a view to obtaining exemption. They had during the half-year under consideration been able to reduce the loan from the Eastern and South African Co. to the extent of £250,000, and the loan at March 31st stood at £200,000. In continuance of the operations which had been fully explained at previous meetings, they had charged against general reserve fund £195,290 in respect of new cables, and the balance of expenditure under this suspense account, to be dealt with in future years, now amounted to £255,000. Capital expenditure had been reduced by an amount of £70,000; this represented the cost price of shares they held in "other companies," which had been paid off. The amount actually received for the shares was in excess of that paid for them; as, however, the transaction was not actually completed on the date to which the accounts were prepared, the difference between cost and realisation would be dealt with in the current half-year. The net result of working for the year ended March 31st, 1905, was that they were able, after making provisions for the reserve funds, to pay the usual dividend of 5 per cent. and a bonus of 2 per cent., and to carry forward a small balance.

Sir John Denison Pender seconded the adoption of the report.

In answer to questions, the Chairman said he would prefer not to enter into the questions of the withdrawal of concessions by Colonial Governments in respect to the Pacific cable.

The report was adopted, and the meeting ended with the usual vote of thanks.

Buenos Ayres and Belgrano Electric Tramways Co.

The directors announce that approximately the result of the working for the half-year ended June 30th last is as follows:—Receipts, £86,400, against £85,096 in 1904, and expenses £51,500, against £45,624. Adding the amount brought forward, £2,086, the balance available is £36,986. The increased expenditure is due partly to the higher wages bill rising from the concessions made to the employés in December last, and partly to exceptional repairs to rolling stock, &c. After allowing for interest on debenture stocks, preference dividends and setting aside £4,000 to meet the half-year's contributions to the renewals fund, debenture sinking fund, and accidents insurance fund on the same scale as those made in 1904, there would remain a balance of £10,239. This would allow of the payment of the same interim dividend as last year (1s. 6d. per share) with a carry forward of £2,739; but having regard to the uncertainty as to the effect on the company's traffics of the approaching electrification of directly competing lines of other companies, the directors have decided not to pay an interim dividend, but to await the final accounts for the year before fixing the distribution to the ordinary shareholders.

Anglo-American Telegraph Co.

The directors' report shows that the total receipts from January 1st to June 30th, 1905, including the balance of £3,194 brought forward from the last account, amounted to £183,678.

The traffic receipts show an increase of £15,711 as compared with the half-year ended June 30th, 1904. The working expenses of the half-year, including expenses of ss. *Minia*, pensions account, &c., as shown by the revenue account, amounted to £70,925, being an increase of £7,347 as compared with the corresponding period of 1904. The directors, under the powers conferred upon them by the Articles of Association, have, before declaring the net profits, set apart the sum of £10,000 to the renewal fund, leaving a balance of £102,753. Quarterly interim dividends of 15s. per cent. on the ordinary stock, and of £1 10s. per cent. on the preferred stock, were paid on May 1st, 1905, absorbing £52,500, and second quarterly interim dividends of 14s. per cent. on the ordinary stock, and £1 8s. per cent. on the preferred stock, amounting to £49,000 will be paid on August 5th, 1905. The balance of £1,253 will be carried forward to the next account. All the main cables and landlines of the company are in good working order.

Blackpool Electric Tramways (South). — A few weeks ago an extraordinary general meeting resolved upon voluntary liquidation and the division among the shareholders of certain shares held in another company. On 24th ult., however, according to a Preston paper, the debenture-holders met and raised objections to this proposal, urging that it should not be carried out until all questions pending between the committee and the trustee had been finally disposed of, and until the debenture-holders had received their money. The ordinary shareholders, at a subsequent meeting, resolved not to proceed at present with the winding-up.

Prospectuses.—*The Urban Electric Supply Co., Ltd.*—This company has been before the public this week (the List was to close on Wednesday, August 2nd) with an issue at par of 20,000 five per cent. cum. pref. shares of £5 each. The dividend is guaranteed until December, 1910, by Edmundson's Electricity Corporation, Ltd. The extensive operations of the company in the provision of lighting and power supply and tramways for a number of small towns are well known to our readers. The present issue is required for paying the contractors who are now carrying out various works in connection with the development of the undertakings.

Buenos Aires Port and City Tramways, Ltd.—This company is before the public (the list is to close to-day) with an issue of £200,000 6 per cent. first debenture stock at par, of which £126,500 has been applied for. The company has a concession from the Argentine Government, without limit as to time, for seven route miles of electric tramway. An estimate of traffic, working expenses and profit prepared by the consulting engineers, Messrs. Kincaid, Waller & Manville, appears in the prospectus. Mr. J. Kerr (of Dick, Kerr & Co., Ltd.), is on the board.

National Gas Engine Co.—The directors have resolved to pay an interim dividend at the rate of 15 per cent. per annum on the ordinary shares for the six months ended June 30th.

Stock Exchange Notices. — The Committee has appointed a Special Settling Day as under :—

August 15th.—Hastings and District Electric Tramways Co., Ltd., £125,000 4½ per cent. debenture stock,

and ordered the undermentioned securities to be quoted in the Official List :—

Sunderland District Electric Tramways, Ltd., £160,000 5 per cent. first mortgage debentures of £100 each, Nos. 1 to 1,600.

The Committee has been asked to appoint a Special Settling Day in and to grant a quotation to :—

Yorkshire (West Riding) Electric Tramways Co., Ltd., £275,000 4½ per cent. first debenture stock,

and to allow the following securities to be quoted in the Official List :—

Edmundson's Electricity Corporation, Ltd., further issue of 10,000 ordinary shares of £5 each, fully paid, Nos. 70,001 to 80,000.

Blackpool & Fleetwood Tramroad Co.—The directors recommend the payment of a dividend at the rate of 4 per cent. per annum for the half-year ending June 30th, which is the same as that for the corresponding period of last year. It is proposed to place £500 to depreciation reserve and £288 to general reserve, and £64 is to be carried forward.

Calcutta Electric Supply Corporation.—The number of units delivered to consumers during the five weeks ending June 30th, 1905, were 550,733, compared with 383,457 in the corresponding five weeks of the preceding year.

Consolidated Electrical Co.—This company's annual meeting was held on Wednesday. Mr. Herbert Allen moved the adoption of the report, which showed an adverse balance on trading of £3,596, which is reduced by sundry revenue credits to a net loss on the year of £717. The report was adopted. Our account of the meeting is held over until next week.

City Meetings.—The half-yearly meeting of the Central London Railway was held on Wednesday, and those of the Waterloo and City Railway Co. and the Great Northern, Brompton & Piccadilly Railway Co. took place yesterday.

STOCKS AND SHARES.

Wednesday evening.

Stock Exchange prices developed an unlooked-for strength earlier in the week, cheaper money being the keystone upon which advances were built all round the markets. Part of the improvement, however, eased off with the slackening of business as the holidays came nearer. In the electrical departments the tone generally is good. Supply shares in particular are firm, and the last results of the recent nervousness have disappeared. There was a plentiful deduction of dividends from electrical prices last week, and in a good many cases the amounts have been already recovered.

Most of the electric supply companies having now withdrawn their opposition to the Administrative Power Bill, the market has regained its accustomed serenity, and quotations reflect the satisfaction at the way in which this matter has been smoothed over. Several of the changes are in the direction of narrower margins between the selling and buying prices, most of them showing a rise in the lower figures. Bromptons, Countys, Edmundson's, London Electric Preference, St. James's Preference, Westminsters—these are all ⅛ to ½ higher on the week. Kensington's are *ex* 5s., and display no alteration in price. It is a little singular that the St. James's Ordinary should be 10s. lower, *ex* 5s. dividend. The Charing Cross City Undertaking Preferences are $\frac{1}{16}$ off at 4⅞. Urbans are unaffected by the issue of new Preference shares at par, which seem to be a desirable investment. Underwriters who have to take any shares that are left over will probably consider themselves fortunate. We hear, by the way, that the Buenos Ayres Lacroze Debenture issue met with a somewhat lukewarm welcome from the public. The Adelaide Supply Preference, lately offered, command a premium of about $\frac{3}{16}$ per share. Midland Electric Debentures have stiffened to par.

To those interested in such things, the quotation for Westminster Ordinary, 12 to 12¾, may appear a trifle odd. There are not many official quotations which have a difference of 15s. in their prices, and Westminsters at the present time are noteworthy on this account.

Railway stocks have moved but little. Metropolitan Consolidated provided a feature by advancing to 91¼, *ex* the dividend of 1½ per cent., while Districts are a trifle better at 36½, upon the further extension of the electrical system. The City and South London meeting on Tuesday gave Mr. C. G. Mott an opportunity for declaiming against the competition of the L.C.C. trams, and for pointing hopefully to the time when the City and South London should have its extension ready to Euston and St. Pancras. The price of the stock stays at 39. Central London Ordinary relapsed to 91, although the dividend comes off the price on August 16th. The report of the Great Northern and City shows that the line is advancing in public favour, but the Preferred "A" shares are not better than 5. The shocking accident on the electrified portion of the Lancashire and Yorkshire Railway made no difference to the price of the company's Ordinary stock, 105½, despite the compensation claims that will, no doubt, be made.

One of the first important issues after the holidays will be an offer of 4½ per cent. Debenture stock and 6 per cent. Preference shares by the Bombay Tramways Co. The amount of each class of security may be £600,000. An issue of £200,000 6 per cent. Debenture stock is being made by the Buenos Ayres Port and City Tramways. Traction descriptions are steady, Calcuttas especially having been in demand. The price has risen to 9¼, and the buying is said to be "Indian," a guess that ought to be safe from fear of contradiction. Buenos Ayres and Belgrano are quieter at 3½, but British Electric Tractions again came to market after the dividend was deducted, and at 8½ the price is by no means strong. The report is still the reason upon which at least some of the selling is grounded. Birmingham and Midland Trams Debenture has advanced to the round 100, and Auckland Debenture, consistently recommended here since the time the stock stood at 96, is 105, with very little left on offer. British Westinghouse Preference look rather more healthy at $2\frac{9}{16}$. There does not seem to be much chance of a dividend forthcoming this year.

Variations in the telegraph section are mainly due to *ex* dividend markings, and salient features are difficult to discover. The Anglo-American Telegraph group has surmounted the disappointment caused by the distribution announced the other day, and all three stocks have advanced, the Deferred being ⅜ to the good. Great Northerns are 10s. higher at 35½, and so are Indo-Europeans at 52½. Several Debenture stocks have small improvements to their credit. Globe Telegraphs of both kinds are a shade up. The National Telephone issues have also been shorn of their dividends, and the Preference shares rapidly replaced the lost fractions. The market for these descriptions is aided by the issue of the Telephone Commission report. Telephone Deferred, however, has fallen 1, to 105.

Babcock & Wilcox new shares were officially valued in the Stock Exchange at 2½ premium the other day, this applying, of course, only to the market quotation at the time that some official price had to be fixed. Cromptons are 1⅜, and India-Rubbers are ½ easier at 15½. The Manufacturing list has nothing more of interest to call for mention.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last four years. 1902.	1903.	1904.	§ 1905.	Closing Quotations July 26th.	Closing Quotations August 2nd.	Business done week ended August 2nd, 1905. Highest	Lowest.	Rise + or Fall —
34,800	African Direct Telegraph, 4 % Debs...	100	4 %	4 %	4 %	..	98—101	98 —101	..	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	2¼— 2⅜	2¼— 2⅜	2 11/16	..	..
119,700£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	Nil	..	70 — 75	70 — 75	73	..	..
763,580	Anglo-American Telegraph	Stock	60/6	61s.	2⅜%	..	58 — 60	58 — 60 xd	..	..	..
3,118,210	Do. do. do. 6 % Pref.	Stock	6 %	6 %	5⅝%	..	105½—106½	105½—106½ xd	106⅜	104½	..
3,118,210	Do. do. do. Deferred	Stock	1/-	2s.	Nil	..	12⅞— 13⅛	13⅛— 13⅜	14⅛	12⅞	+ ⅜
44,000	Chili Telephone, Nos. 1 to 44,000	5	6 %	7 %	8 %	..	7¼— 7⅜	7 — 7¼	..	..	..
1,932,856£	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	..	96½— 98½	96½— 98½	98	97½	..
16,000	Cuba Telegraph	10	6½%	10 %	5 %	..	8¼— 9	8 — 8½	8⅛	8⅛	— ½
6,000	Do. 10 % Pref.	10	10 %	5 %	10 %	..	17 — 18	17 — 18	..	..	..
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3⅜— 3⅝	3⅜— 3⅝	..	..	..
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	..	9 — 9¼	9 — 9¼	..	..	..
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	..	100 —103	100 —103	..	..	..
60,710£	Direct United States Cable	20	3⅜%	3 %	3¼%	..	11¼— 11½	11¼— 11½ xd	..	..	..
74,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200,R.	100	4½%	4½%	4½%	..	99 —101	99 —101	..	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	146 —149	104¼—106½ xd	146½	143	..
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	..	89 — 91 xd	89 — 91 xd	90½	89½	..
1,836,814	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	..	107 —109	107 —109	108½	108½	..
300,000	Eastern Extension, Australiasia, and China Tele.	10	7 %	7 %	7 %	..	13¾— 14¼	13⅞— 14¼	14½	13⅞	..
602,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	..	106 —108	107 —109	105⅞	105½	+1
300,000	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	..	101 —103	99 —101 xd	..	..	..
200,000£	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	..	100¾—102¼	101 —103	..	..	+ ½
180,887	Globe Telegraph and Trust	10	£3 16 7*	5½%	5½%	..	10⅝— 10⅞	10⅝— 10⅞ xd	10⅞	10⅝	..
180,887	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	14¼— 14½	14⅜— 14⅝ xd	14⅝	..	..
150,000	Great Northern Telegraph, of Copenhagen	10	12½%	15 %	24 %	..	34½— 35½	35 — 36	35	..	..
46,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	..	99 —101	99 —101	..	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	13 %	..	51 — 53	51½— 53½	52⅝	52¼	+ ½
72,680	Monte Video Telephone Co., Ltd. Ord. ..	1	3 %	3 %	..	..	2¾— 2⅞	2¾— 2⅞	..	..	..
1,983,333	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	111 —112	108 — 109 xd	109	108½	..
1,966,667	Do. do. Def. Stock	100	4½%	5 %	5 %	5 %	107 - 109	104 — 106 xd	106⅜	105	..
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	13 — 14	12½— 13½ xd	..	..	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	..	..	..
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 6	5⅜— 5⅞ xd	5⅝	5⅜	..
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	..	99 —101	99 —101	100½	99½	..
1,689,593	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	..	102½—104½	102½—104½	104⅛	103	..
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6 %	6½%	6½%	..	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	..	1⅛— 1¼	1⅛— 1¼	..	..	..
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	..	97 —100	97 —100	..	..	..
11,839£	Reuter's	8	5 %	5 %	5 %	..	7½— 8	7½— 8	..	..	..
3,237	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	126—129	126 —129	..	..	..
58,000	United River Plate Telephone	5	7 %	8 %	8 %	..	6⅞— 7⅛	6⅞— 7⅛	7⅛	..	..
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5⅛— 5⅜	5⅛— 5⅜	..	..	..
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	..	107 —109	107½—109½	..	..	+1
15,609£	West African Telegraph, Shares	10	2 %	4 %	4½%	..	8¼— 9	8½— 9	..	..	..
30,008	W. Coast of America, 1 to £0,000 & 53,001 to 53,008	2½	Nil	Nil	Nil	..	7 9/16— 7 13/16	7 9/16— 7 13/16	..	..	..
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	..	99 —101	99 —101	..	..	..
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930 ..	10	7 %	7 %	7 %	..	13⅜— 14¼	13⅜— 14¼	14⅛	13 13/16	..
75,000	Do. do. 5 % Debs. 2nd series, 1906	100	5 %	5 %	5 %	..	100 —104	100 —102	..	..	..
563,380	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	..	101 —103	102 —104	103	102	+1
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅜— ⅝	½— ⅝	..	..	..
34,563	Do. do. 6 % Cum. 1st Pref.	10	7 %	7 %	6 %	..	8 — 8½	8 — 8½	..	..	..
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	5⅜— 6¼	5⅜— 6¼	..	..	..
80,000£	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	..	101 —104	100 —103	101½	..	—1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

40,000	British Aluminium 7 % Cum. Pref.	5	Nil	Nil	Nil	..	4⅜— 5⅛	4⅜— 5⅛	..	..	..
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	Nil	Nil	..	4⅜— 5⅛	4⅜— 5⅛	5	..	..
20,000	Do. do. 4 % Funding Certs.	5	..	..	..	..	2⅜— 3⅛	2⅜— 3⅛	..	..	..
300,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	99 —103	99 —103	..	..	..
133,301	British Electric Traction	10	8 %	6 %	6 %	..	8⅜— 9⅛	8⅛— 8⅜	8⅜	8⅛	— ⅛
156,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	11 — 11½	11 — 11½	11½	11	..
1,000,000£	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	121 —123	122 —124	122½	122¼	+1
250,000	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	..	4½%	..	97 — 99	97 — 99	98	97	..
100,000	British Insulated and Helsby Cables	5	10 %	8 %	8 %	..	5⅞— 6	5⅞— 6	..	..	..
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	..	5⅞— 6	5⅞— 6 xd	..	..	..
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	..	101 —104	101 —104	..	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	1/16— 1/8	1/16— 1/8	..	..	..
50,000	¶ Do. do. 6 % Cum. Pref. ..	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	..	⅛— ¼	⅛— ¼	..	..	..
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1 — 1⅛	1 — 1⅛	..	..	..
125,000£	Do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	..	92 — 95	92 — 95	..	..	..
125,000£	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	..	77 — 80	77 — 80	..	..	..
35,000	Callender's Cable Construction shares	5	15 %	12½%	12½%	..	10 — 11	10 — 11	..	..	..
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛— 5⅜	5⅛— 5⅜	5⅜	..	..
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	..	106 —108	106 —108	..	..	..
1,963,208	Central London Railway, Ord. Stock ..	Stock	4 %	4 %	4 %	..	91 — 93	90 — 92	91½	90¼	—1
523,396	Do. do. 4 % Pref. Stock ..	Stock	4 %	4 %	4 %	..	101 —103	101 —103	102¼	102⅛	..
523,396	Do. do. Def. do.	Stock	4 %	4 %	4 %	..	78 — 81	78 — 81	79	..	..
1,330,000	City and South London Railway	Stock	3½%	2⅞%	2⅞%	2 %	38 — 40	38 — 40	39	38	..
85,000	Crompton & Co., Nos. 1 to 85,000	3	5 %	2½%	2½%	..	1½— 2	1½— 2 xd	..	..	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	..	94 — 99	94 — 99	..	..	..
99,261	Edison & Swan Utd., "A" shrs., £3 pd., 1 to 99,261	5	Nil	Nil	..	..	1⅜— 1⅝	1⅜— 1⅝	1 5/16	..	..
17,139	Do. "A" shares, 01—017,139 ..	5	Nil	Nil	..	..	2 — 2⅛	2 — 2⅛	..	..	..
344,023£	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	83 — 88 xd	83 — 88	..	..	..
100,000£	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	89 — 94	89 — 94	..	..	..
112,100	Electric Construction 1 to 112,100	2	6 %	4 %	Nil	..	⅜— ⅝	⅜— ⅝	..	..	..
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	..	1¼— 2⅛	1¼— 2⅛ xd	..	..	..
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Sk.	Stock	4 %	4 %	4 %	..	93 — 96 xd	93 — 96	..	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	9⅛— 10	9⅛— 10	..	..	..
200,000	Do. do. 4 % Mort. Deb. ..	Stock	4 %	4 %	4 %	..	97 —101	97 —101	..	..	..
200,000	Henley's (W. T.), Telegraph Works, Ord. ..	5	20 %	15 %	15 %	..	11½— 12½	11⅝— 12¼	..	..	..
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	..	⅝— 5/8	⅝— ⅝	5/8	..	..
45,900	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	..	109 —111	109 —111	109½	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works..	10	10 %	10 %	..	..	15⅛— 16⅛	15 — 16	..	..	— ½
300,000£	Do. do. 4% 1st Mort. Deb. ..	100	4 %	4 %	4 %	..	100 —103	100 —103	..	..	..
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	13⅜%	1¼%	..	2¼— 3¼	2¼— 3¼	..	..	..
10,000	† Do. do. Pref. £10 paid ..	10	5 %	5 %	5 %	5 %	9¼— 9¾	9¼— 9¾	..	..	..
37,350	Telegraph Construction and Maintenance ..	12	20 %	23 %	15 %	..	31 — 33	31 — 33	..	..	..
150,000£	Do. 4% Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	..	101 —103	101 —103	..	..	..
540,000£	Waterloo & City Railway, Old. Stock	100	3⅛%	3⅛%	3⅛%	3 %	90 — 92	90 — 92	..	..	..

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § Interim dividends.
¶ From Manchester Share List.

Bank rate of discount 2½ per cent. (March 9th, 1905).

SHARE LIST OF ELECTRICAL COMPANIES *(continued)*.—ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1902.	1903.	1904.	‡1905.	Closing Quotations July 26th.	Closing Quotations Aug. 2nd.	£Business done week ended Aug. 2nd, 1905. Highest	Lowest.	Rise + or Fall —
		†									
29,377	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	8 %	10 %	10 %	..	9½ — 10½	10 — 10½	..	..	+½
10,623	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	9 — 10	9⅝ — 10⅛	9⅞	..	+⅛
288,782	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	..	103 —106	103 —106	..	..	..
80,000	Charing Cross and Strand Electricity Supply ..	5	10 %	8 %	8 %	..	6⅜— 7⅛	6⅜— 7⅛	6⅝	6⅜	..
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	..	5⅛— 5⅜	5⅛— 5⅜	..	..	..
40,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	..	4⅜— 5	4⅜— 5	4⅞	4	—⅛
40,000	Do. do. 1903	5	4½%	4½%	4½%	..	4⅜— 5⅛	4⅜— 5	4½	..	—⅛
350,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	..	104 —106	104 —106	105	..	..
44,436	*Chelsea Electricity Supply, Ord. ..	5	4½%	5½%	6 %	..	6 — 6½	6 — 6½	..	..	..
150,000£	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	..	108 —110	108 —110	108½	..	..
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	5 %	6 %	..	10½— 11½	10½— 11	10 1/16	10⅛	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	..	13 — 14	13 — 14	13	..	..
400,000£	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	..	122 —126	122 —126	..	..	..
300,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	..	103 —105	103 —105	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4 %	4½%	4 %	8 — 9	8½— 9	..	..	+¼
30,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	11⅜— 12⅝	11⅜— 12⅝	..	..	..
400,000£	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	..	111 —114	111 —114	113	..	..
250,000	Do. do. 4½ % 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	..	103 —105	103 —105	..	..	..
70,000	Edmundson's Electric Corporation, Ord. Shares ..	5	7 %	7 %	7 %	..	5⅜— 6⅛	5⅜— 6⅛	6	5 13/16	+⅛
80,000	Do. do. 6 % Cum. Pref... ..	..	6 %	6 %	6 %	..	6⅛— 6⅜	6⅛— 6⅜	..	..	+⅛
300,000£	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	..	105⅛—107⅛	105⅛—107⅛	106	..	..
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	12 %	12 %	..	11¼ — 12¼	11¼ — 12¼xd	12	..	..
136,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	..	98 —101	97 —100 xd	..	..	..
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	Nil	3 %	..	1⅞— 2⅛	1⅞— 2⅛xd	..	..	..
60,000	Do. do. do. 6 % Pref...	5	6 %	6 %	6 %	..	4⅞— 5⅛	5 — 5⅛	..	..	+¼
371,895	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	..	99 —102	99 —102	..	..	..
100,000	Metropolitan Electric Supply, 1 to 100,000	5	7½%	8⅜%	10 %	10%	9¼ — 10	9¼ — 10	9 7/8	9 1/16	..
76,121	Do. 4½ % Cum. Pref. 1—71,106, £3 pd.	5	4½%	4½%	4½%	..	5⅝— 5⅞	5⅝— 5⅞	..	..	..
220,000£	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	..	109 —113	109 —113	..	..	..
250,000£	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	..	98 —100	98 —100	..	..	..
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	..	99 —101 xd	99 —101	..	..	..
10,852	Notting Hill Electric Lighting	10	6 %	6 %	7 %	..	14 — 15 xd	14 — 15	..	..	..
59,000	Do. do. 4 % 1st Mort. Deb... ..	100	4 %	4 %	4 %	..	100 —102	100 —102	..	..	..
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	14½%	14½%	14½%	10%	13½— 14½	13 — 14 xd	13¾	13½	..
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	8 — 9	8 — 9 xd	..	..	..
150,000£	Do. do. 3½ % Deb. Stock Red. ..	100	3½%	3½%	3½%	..	97 — 99	97 — 99	..	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	2½%	4 %	4 %	..	2⅜— 3	2⅜— 2⅞	..	..	—⅛
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	..	78 — 82	76 — 80 xd	..	..	..
65,000	South London Electricity Supply, Ord.	5	1½%	3 %	4 %	..	3¾— 4	3¾— 4	..	..	..
100,000	South Met. Elec. Lt. & Power (Ord..	1	Nil	Nil	Nil	..	7/8— 1	7/8— 1	..	..	..
50,000	*(Late Blackheath and Greenwich* 7 % Pref... ..	1	Nil	7 %	7 %	..	1¼ — 1⅜	1¼ — 1⅜	..	..	..
100,000	*Dist. E.L.Co.)* (4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	..	106 —109	106 —109	..	..	..
30,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	4⅜— 4⅝	4⅜— 4⅞	..	..	..
30,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛— 5⅜	5⅛— 5⅜	..	..	..
200,000	Do. do. 4½ % 1st Mort. Deb. Stk. Red	100	..	..	4½%	..	104 —106	104 —106	105½	..	..
110,000	Westminster Electric Supply, Ord.	5	12 %	13½%	14 %	13%	11¾— 12¼	12 — 12⅜	12⅜	12	+⅛
28,151	Do. do. 5 % Cum. Pref. ..	5	5 %	5 %	5 %	..	6⅛— 6⅜ xd	6⅛— 6⅜	..	..	..

Shares not officially quoted :—Mackay Companies, ord., 41⅜—42¼. Pref. 76—76½.

*Subject to Founders Shares † Unless otherwise stated all shares are fully paid. ‡ Interim dividends.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

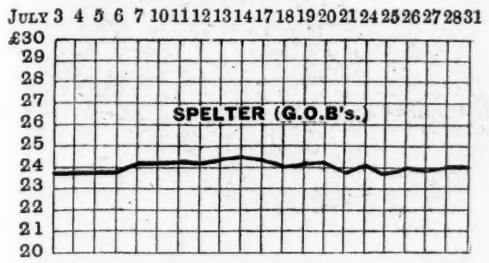
Locality.	Fortnight ended.	Receipts for the fortnight. £	£*	No. of wks.	Total to date. £	£*	Route miles open.	*
Aberdeen	July 29	3,383	— 183	9	13,987	— 587	14·1	..
Ayr	,, 22	1,338	— 31	10	3,968	— 105	8	..
Bath	,, 26	1,591	+ 161	30	19,525	+ 1,606	13	..
Birkenhead	,, 30	2,246	— 246	17	18,393	— 479	13·5	..
Blackburn	,, 26	2,100	+ 17	17½	17,786	+ 602	14·25	..
Blackpool	,, 27	3,548	— 360	17	18,906	+ 1,282	11·87	..
,, —Fleetw'd	,, 29	2,257	— 506	4	4,164	— 699	8	..
,, —Lytham	June 22	1,602	+ 753	34	7,608	..	7½	..
Bolton	July 30	4,135	+ 192	18	35,027	+ 1,175	26	+ 1
Bournemouth ..	,, 26	3,213	+ 888	16½	21,473	..	13·9	..
Bradford	,, 29	8,600	— 478	17	77,554	— 2,785	83	..
Brighton	,, 31	2,546	+ 56	18	18,267	..	9·5	..
Bristol	,, 28	10,912	+ 174	..	..	..	28·5	..
Brit. Elec. Trac. Co.								
Airdrie	July 21	432	— 21	29	3,777	— 12	8·5	..
Barnsley	,, 21	314	— 29	,,	4,623	— 137	3	..
Barrow	,, 21	580	+ 32	,,	6,664	+ 1,691	5·37	..
‡Birmingham (City)	,, 21	10,469	— 696	,,	159,823	+ 4,703	14·5	..
Birmingham (Mid.)	,, 21	2,830	— 636	,,	48,779	+ 3,653	12·25	..
Devonport ..	,, 21	1,009	— 141	,,	13,266	— 1,602	8·85	..
Dudley—Sto'rb'ge	,, 21	2,151	+ 148	,,	25,380	+ 1,305	21·25	..
Gateshead	,, 21	1,914	— 52	,,	26,161	+ 511	11·25	..
Gravesend, N'fleet	,, 21	559	— 98	,,	6,427	— 757	6·5	..
Gr'n'k, Pt. Glsgw	,, 21	1,568	— 5	,,	18,128	+ 2,215	7·25	..
Hartlepool ..	,, 21	618	— 171	,,	7,423	— 796	6·72	..
Kidderminster ..	,, 21	356	— 32	,,	3,361	— 173	4·5	..
†Leamington ..	,, 21	251	+ 96	,,	251	+ 96	..	..
Merthyr	,, 21	403	— 23	,,	5,515	— 255	2·9	..
‡Metropolitan ..	,, 21	7,022	+3,770	,,	70,362	+35,114	..	..
Middleton	,, 21	989	+ 111	,,	9,786	+ 557	8·5	..
Oldham — Ashton	,, 21	1,254	— 5	,,	15,702	+ 167	9·13	..
Peterborough ..	,, 21	330	— 43	,,	3,807	— 334	5·31	..
Potteries	,, 21	3,414	— 236	,,	48,572	+ 208	29	..
Rothesay	,, 21	1,511	+ 435	,,	4,295	+ 665	2·75	..
Sheerness	,, 19	186	+ 8	,,	1,931	+ 270	2·5	..
Southport	,, 21	821	+ 4	,,	8,640	— 301	8·17	..
South Staffs. ..	,, 21	1,576	+ 249	,,	20,419	— 124	13·87	..
Swansea	,, 21	1,794	+ 230	,,	18,606	+ 3,368	5·5	..
Taunton	,, 21	118	— 15	,,	1,375	— 158	1·5	..
Tynemouth	,, 21	875	— 5	,,	7,106	— 905	3·75	..
Weston-s-Mare ..	,, 19	643	— 18	,,	2,917	+ 212	3	..
Wolverhampton D.	,, 21	870	..	,,	10,989	+ 31	14·75	..
‡Worcester	,, 21	733	— 35	,,	8,551	+ 733	5·75	..
Wrexham	,, 21	225	— 10	,,	2,884	— 288	4	..
Yorks. Wool. Dist.	,, 21	1,504	+ 32	,,	18,291	+ 1,392	17	..
Burnley	July 29	2,159	+ 70	..	..	..	7·5	..
Burton-on-Trent ..	,, 30	689	— 124	17	5,699	— 544	8·5	..
Bury	,, 23	1,744	..	16	11,995	..	10·5	..

Locality.	Fortnight ended.	Receipts for the fortnight. £	£*	No. of wks.	Total to date. £	£*	Route miles open.	*
†Cardiff	July 22	2,211	+ 49	16	34,703	+ 697	29·37	..
Carlisle	,, 29	472	— 8	30	5,484	— 386	7	..
Chatham and Dist.	,, 27	1,785	+ 415	30	19,475	+ 2,151	9·3	+ ·8
Colchester	,, 26	520	..	52	11,320	..	7	..
Cork	,, 27	1,211	+ 89	30	14,452	+ 724	9·19	..
†Darlington	,, 22	236	+ 10	16	3,307	..	4·87	..
Darwen	,, 28	483	+ 18	17	4,229	+ 202	4·36	..
Dover	May 13	394	+ 10	19	3,396	— 65	3·5	..
Dublin	July 28	11,191	+ 10	..	22,537	+ 508	48·5	+ 1½
Dundee	,, 26	1,932	+ 43	..	..	..	4·25	..
East Ham	,, 29	1,780	+ 221	17	14,728	+ 1,234	6·62	..
Glasgow	,, 29	26,079	+1,111	8½	130,826	+ 7,295	76	+ 5
Gloucester	,, 26	692	— 144	16½	5,328	..	15	..
†Halifax	,, 26	1,729	+ 160	17	27,656	+ 1,031	35·5	+ 2½
Huddersfield ..	,, 29	2,941	+ 250	17	23,019	+ 1,220	28	..
Hull	,, 29	4,451	+ 11	17	37,397	+ 88	13	..
Ilford	,, 8	1,094	+ 55	14	7,039	— 98	6·5	..
Ilkeston	,, 26	260	— 42	17	2,157	— 366	3·5	..
Ipswich	,, 29	1,060	— 119	17	7,954	— 792	10·5	..
Isle of Thanet ..	,, 29	2,687	— 279	30	15,752	— 848	11	..
Kirkcaldy	,, 26	629	— 69	..	..	..	5·5	..
Lan'kshire Trm. Co.	,, 27	1,726	+ 152	30	20,237	+ 1,381	12·06	+ 3·4
Leeds	,, 15	13,248	+ 718	16	96,902	+ 4,173	89·5	+ 8
Leicester	,, 29	4,767	..	30	61,634	..	23	..
Liverpool	,, 22	22,730	—3,209	29	303,470	+ 6,195	103	..
L.C.C.	,, 15	33,117	+4,292	15	227,411	+43,398	52·12	+ 5·3
Lowestoft	,, 29	633	— 34	48	6,969	— 368	4	..
Manchester	,, 29	26,677	+ 707	17	227,451	+10,992	84	..
Newcastle	,, 29	7,666	+ 18	17	66,876	+ 2,363	25·3	..
Newport	,, 14	1,294	+ 198	15	9,145	+ 1,460	8·5	..
Oldham	,, 30	3,429	+ 941	18	29,884	+ 8,117	23·75	+ 5⅝
Plymouth	..	..	..	..	..	..	4·1	..
Pontypridd	,, 29	310	..	17	2,921	..	3·75	..
Portsmouth	,, 22	4,923	— 137	16	33,263	— 366	14·5	..
†Reading	,, 30	592	— 29	16	10,623	— 3	7·5	..
Rochdale	,, 29	1,773	+1,387	16	12,500	+ 9,949	18·8	+ 14½
†Salford	,, 24	4,432	+ 105	17	74,301	+ 5,298	90	..
Scarborough ..	,, 29	713	..	30	3,759	..	4·5	..
Sheffield	,, 30	9,971	+ 375	18	99,337	+ 4,357	34·25	+ 1½
†Southampton ..	,, 19	1,072	— 2	16	15,704	— 224	11	..
Southend-on-Sea ..	,, 26	1,089	+ 67	17	6,596	+ 468	6·25	..
Stockport	,, 21	1,998	+ 575	16	10,941	+ 1,085	14·5	+ 3
†Sunderland	,, 30	1,609	+ 237	17	23,460	+ 567	10·87	..
Tyneside	,, 26	924	+ 24	30	12,587	+ 1,324	8·87	..
†Warrington	,, 20	361	+ 24	16	5,398	+ 198	7·75	..
West Ham	,, 27	3,514	+1,287	17	27,170	..	10·95	+ 2·9
Wolverhampton ..	,, 26	1,727	+ 195	17	13,800	..	10	..
Cen. London Rly.	July 29	11,619	— 363	4	24,043	— 585	6	..
City & S. Lon. Rly.	,, 30	4,498	— 202	4	9,056	— 252	6·25	..
Dublin-Lucan Rly.	,, 28	307	+ 6	4	606	— 26	7	..
G. N. and City Rly.	,, 29	2,894	+ 944	4	5,852	+ 1,975	3·5	..
L'pool Overh'd Rly.	,, 30	3,317	— 219	..	..	..	6·75	..
Mersey Railway ..	,, 29	3,022	— 18	4	6,060	+ 197	4·5	..

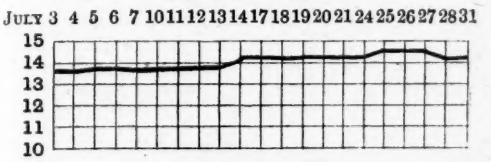
* Compared with the corresponding period of 1904. † One week only. ‡ Includes horse and other receipts.

METAL MARKET.

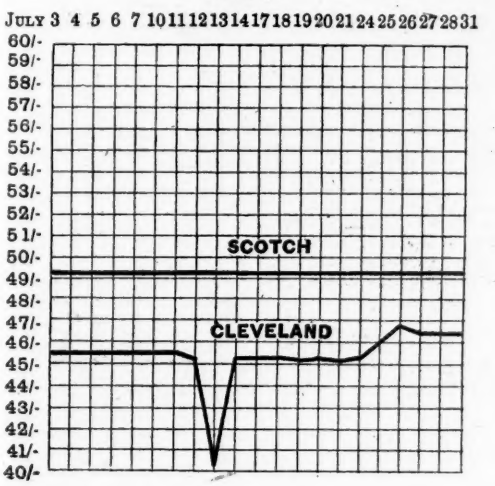
Fluctuations in July.



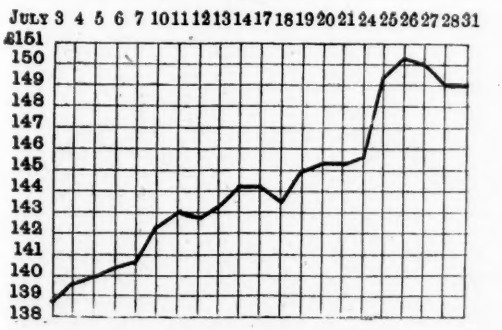
LEAD (ENGLISH).



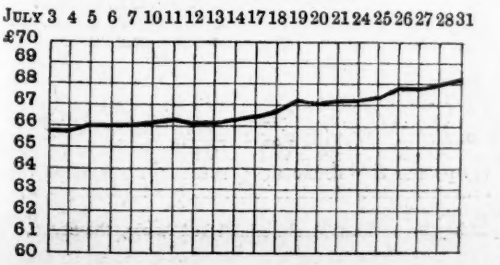
IRON.



TIN.



COPPER (G.M.B's.)



ELECTRIC TRAMWAY AND RAILWAY EXHIBITION, 1905.

Description of Interesting Exhibits.

(Continued from page 161.)

Couplings.—Because of the Governmental ban against trailers tramway managers are inclined to be indifferent as to the kind of coupling with which new cars are to be equipped, and we dare be bound that this indifference has gone so far that, apart from a hole through the centre of the bumper beam and a pin in that, there

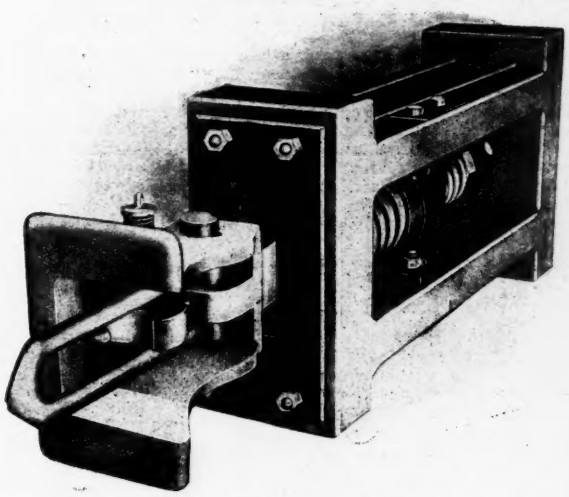


Fig. 26.—A.B.C. Automatic Coupler.

are not a tenth—no, nor a hundredth of the cars running on ou tramways equipped with any coupling arrangement whatever, to say nothing of an automatic coupling.

So much the more reason, would you say, for a good show of couplings at an exhibition and a shower of orders thereafter? We are inclined to think not. Until trailers are used generally—and who would say that the day will never come?—the use of couplings is limited to cases of emergency, such as a broken-down car having to be towed home by a healthy companion, and makeshifts are in the habit of being used on such occasions with some success. When cars having bumpers widely varying in height from rail to centre are in use on the same system, troubles do occur when crippled cars have to be pushed home, but it is an open question whether managers would think these troubles sufficiently acute to go to the expense of fitting all their cars with couplers such as were to be seen at the Exhibition, designed to meet the exigencies of constant use on goods and passenger trains, or at least on the two-car units, which are common things in some European and most American and Asiatic countries.

Nevertheless, the Exhibition, being a tramway and railway exhi-

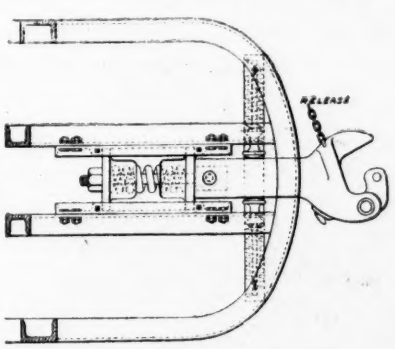


Fig. 27.—Buckeye Auto-coupler.

bition, offered a distinct place for couplers suitable for railways, and among them we noticed, in particular, the stand of the A.B.C. Coupler, Ltd. The action of this coupler is entirely automatic, and it was reported upon by Mr. W. F. Pettigrew (Furness Railway) to the International Railway Congress which was held at Washington this year.

After fully describing the action of the coupler, the report proceeds:—It will be noticed that the shackles never rise above the top of the buffers, consequently they will not interfere with the vestibules of carriages where such are provided, ... this coupler is exceedingly simple in construction, and has few wearing parts, and none of these are subjected to the buffing strains, the latter

being passed through the solid metal of the buffer head and shank to the springs and on to the vehicle. The buffer faces are flat, and when two vehicles meet on a curve the flexible spring arrangement allows the two faces to come together parallel to each other. The coupler is so designed that in the event of the disk hook pin or the disk hook breaking, the vehicles will not be separated, the hook being retained in position by the surrounding metal of the coupler head. A further great advantage is that this coupler will couple up readily with almost any other.

The buffer head and shank (fig. 26) are made from cast-steel of special quality, the shank being drawn out under the hammer or forging press to the required form, and afterwards the whole is thoroughly annealed. The disk hook is preferably a steel stamping, or it may be cast; the shackle locking-bar and pins are forged steel of suitable quality.

Mr. P. A. Hyde, late chief locomotive superintendent of the Central S.A. Railways, has reported entirely in favour of the latest patterns of the A.B.C. coupler.

Messrs. W. S. Laycock, Ltd., exhibited working models of their Buckeye No. 11 light-pattern auto-coupler, of which fig. 27 is an illustration.

This automatic coupler is designed to contour lines, reduced from the Master Car Builders' Association standard, and is especially suitable for light railways, tramcars, and light wagon stock. It can also be fitted with draught gear designed to act as a buffer and coupler combined. Any reasonable amount of lateral motion can be given, enabling the coupler to work satisfactorily on sharp curves; check springs are also provided to bring the coupler central when on the straight. The lock is controlled by gravity, and is released simply by pulling a hand chain fixed to the sill. These couplers are strong, automatic in action and interchangeable, and with modifications in draught gear can be fitted to almost any type of vehicle.

Messrs. Edgar Allen & Co., Ltd., showed the "Imperial" central radial automatic coupling buffer illustrated in figs. 28 and 29. Fig 28 shows the buffer with hook down, ready for coupling, and fig. 29 shows the buffer with hook in position when coupling is not required. These buffers will couple automatically on any ordinary curve, and damage to head and drawbar is reduced to a minimum by the radial movement, which is very sensible to the least impact. Full and empty wagons on different planes couple easily.

Car-Trucks.—The most noticeable thing about the car-trucks exhibited was their British make, and the next that every rigid wheel base four-wheeled truck and every maximum traction truck looked as if it had come straight from America. Now that our truck trade is safely in all-British hands, we see no harm in paying the acknowledgements which in justice we owe to those men who have helped us so practically to develop our tramways. They have helped themselves to their fees for tuition, and as things stand now, we do not believe that our graduates in the difficult craft of truck-building can begrudge them. For nearly 10 years the J. G. Brill Co. shared with another American firm the British market, and the Exhibition that has just passed furnished proof enough that the characteristics by which every man and boy on the tramways of this kingdom learned to recognise the Brill truck have become perhaps as indelibly printed on our British-made trucks as were the characteristic lines of the stage-coach transfused into the bodies of succeeding generations of railway coaches.

To whatever success the J. G. Brill Co. has gained in these islands it is fairly entitled, and we desire to do honour to the man without

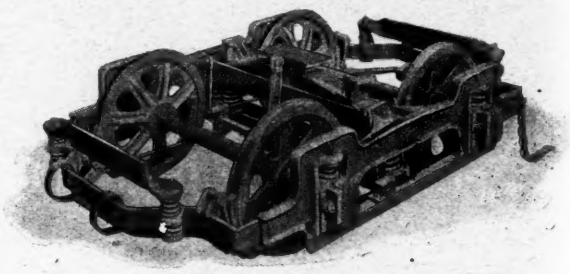


Fig. 30.—Brush Equal-Wheel Bogie Truck.

whose name the title of the firm would excite no more attention here than that of any of its American rivals.

While handing the laurel to Brill, we do not forget the worth of McGuire, to whom our truck builders are indebted for valuable points in design, nor while praising both can we allow our readers to think for more than the moment it has taken them to skip these

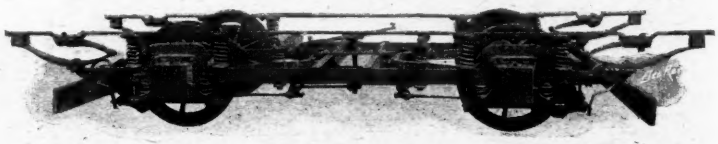


Fig. 31.—Brush Radial Truck.

lines that we desire to belittle our native manufacturers. Far be it from us to blame them for assimilating the best features of previous work, rather should we praise them for choosing so well. Finally, let us rejoice that the conservative enterprise of Englishmen has delivered us from the necessity of buying foreign trucks which, good as they are, cannot equal for material, workmanship and price the Brill-McGuire-Brush, or the Hurst-Nelson-Brill, or the Mountain and Gibson-Brill-McGuire.

That we have advanced in quality of manufacture none who visited the Agricultural Hall can doubt. The steel side-bar forgings especially were remarkable specimens of the best English style, and the care with which the component parts had been assembled so that the frames would trammel true every way was of good omen to us who had seen in days gone by, we believe for ever, the side-frames and the end-sills, the braces and the stays, thrown together with no more respect for the ultimate squareness of the axles than if they had been pieces of a sixpenny tin locomotive.

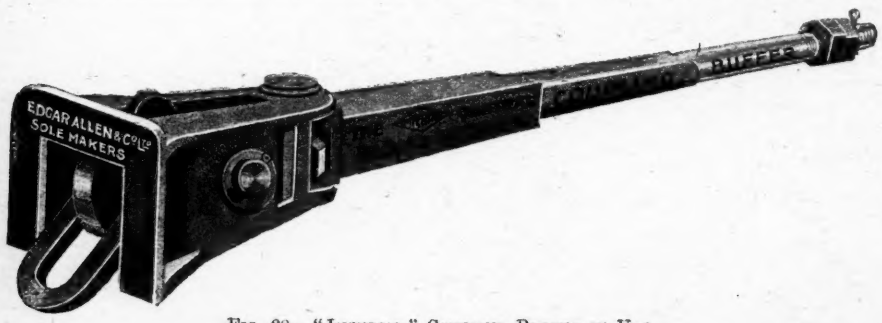


Fig. 28.—"Imperial" Coupling Buffer in Use.

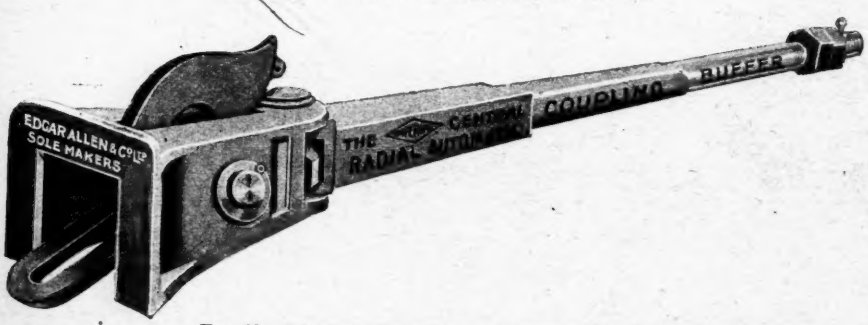


Fig. 29.—"Imperial" Coupling Buffer out of Gear.

In the remarks which preceded this series of articles, we suggested that the demand for radial action trucks will be large, and if only for the excellent reason that a long wheel base permits track renewals to be postponed to a later date than could be done with small wheel-base cars, we think that our prognosis is well founded. On a perfect track a 40-passenger double-deck car carried on a 6 ft. or 6 ft. 6 in. wheel-base rides perfectly, not so perfectly on a track which has lived and suffered, and abominably on rails that have to be kept down for another year. The radial action truck gives us something between a rigid wheel-base and a pair of bogies, and its 8 ft. 6 in. to 9 ft. wheel-base will be utilised not so much to carry a longer car-body with higher seating capacity, as to carry the same sized body as before without bringing the real age of the track too prominently before the passengers, until at least the owners have had time enough to settle the question of a permanent way renewal fund.

Beginning then with that old-established house, the Brush Co.,

it is questionable which was the more interesting, their rolling stock in print or in cold steel and iron. Never, we think, has a more tasteful business attack been made in the history of modern illustrated business literature, and their thoroughly artistic and clever catalogue should do as much to make Brush cars known as the Exhibition itself.

They had an equal-wheeled bogie truck completely equipped, and running on a short track (fig. 30); maximum traction trucks of the "Standard" and "Eureka" types; a standard four-wheel truck, and a radial truck (figs. 31 and 32).

The construction of a truck can be explained almost as well by illustration as by words, and we leave the rest of the description of the trucks here shown to the block-maker. The Brush Co. has issued a special pamphlet on radial trucks, in which it is stated that comparative tests under practical conditions over a 6-mile route resulted in a consumption of ·754 unit per car-mile for a rigid wheel-base, and ·664 unit for a radial truck.

Messrs. Hurst, Nelson & Co. are well known both in the railway and tramway worlds, and their exhibit was fairly representative of what they can do, although they had not enough space for a railway coach or for one of the 12-rail motor-cars which they are building for the G.W.R. We illustrate in fig. 33 the four-wheeled truck shown, but we have no space for their maximum traction truck.

Messrs. Mountain & Gibson are successors to the English McGuire Co., and have works at Bury, Lancashire. The work on their stand was most remarkable for its finish and scrupulous attention to details. It was evident enough that here were people who had laid themselves out first of all to discover, then to understand, then to grapple with, and at last to overcome every disease which attacks even the smallest and the apparently most insignificant part of every truck after several years' run. The people who do not leave a truck directly it is put under a car, but follow that truck through its life and consult from time to time the men who have to live with it, are the people who will master not only the quickest, cheapest and best way of building trucks to a draughtsman's design, but the best way to build trucks which will be the cheapest after 10 years on the hard high road. Our illustrations show a four-wheel rigid truck, fig. 34, and a radial truck, fig. 35.

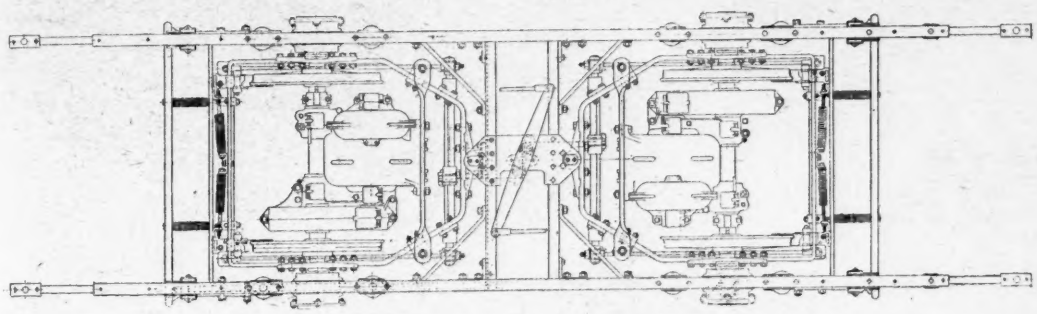


Fig. 32.—Plan of Brush Radial Truck.

There is a noticeable improvement in the motor suspension bars, which are not weakened by the twists which are put into each end as a general rule. Tests have proved the much greater stiffness of the straight bar with forged and welded ends.

The radial truck was the feature of the stand, and naturally it was subjected to many comparisons with its sole rival in the building. In this, as in all things else, the simplest design will win the day.

The M.G. radial truck consists of an intermediate frame composed of steel channels with an arrangement of centre stiffeners and braces, to which are fitted king-pins, forming the pivotal points from which two sub-trucks radiate. These sub-trucks are independent of the intermediate framing, excepting where attached to the king-pin, and the weight of the car body is taken by the intermediate frame, which is supported by an arrangement of rollers mounted upon the sub-trucks and working in separate oil-baths, the under side of the intermediate frames being fitted with hardened steel rub-plates working upon the rollers. The framing of the sub-trucks is of forged steel, fitted with steel horn blocks, within which are fitted the axle-boxes, which are of the usual type, made dust-proof.

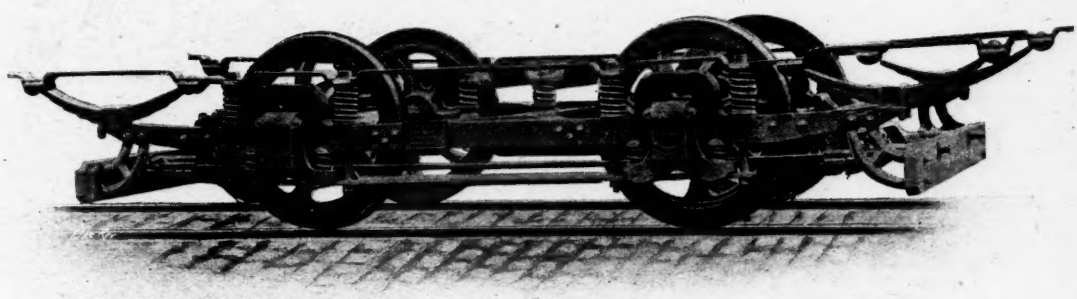


Fig. 33.—Hurst-Nelson Four-Wheel Truck.

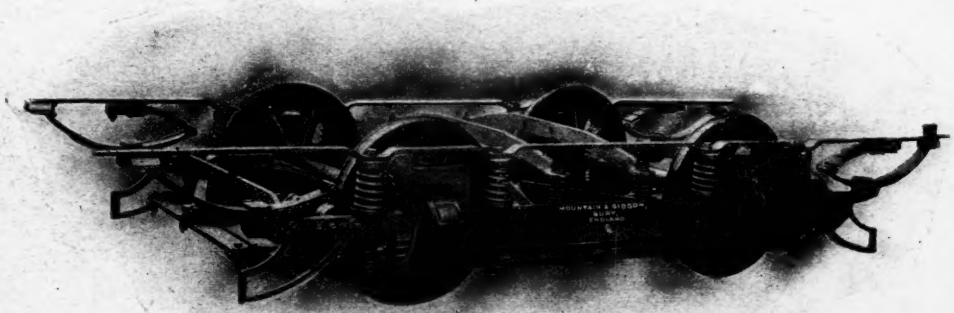


Fig. 34.—Mountain & Gibson Four-Wheel Truck.

Roller Bearings.—Although the Empire Roller Bearing Co. have been before the public with their speciality for some years, the improvements which have been made in the direction of perfec-

tion, and the distrust with which roller bearings of any make have to contend, make it unnecessary to apologise for drawing attention to an article more or less familiar to our readers.

The ordinary journal-brass gives so little trouble, and lasts so long, that the arguments in favour of any change have to be most convincing and often repeated before the average manager can be persuaded to make a trial of the very best roller bearing, and it is by no means certain that a demonstration of so much saving over

numbers are running at Croydon, Liverpool, Barrow and other towns.

We have not the least reason to doubt that the rollers which were shown to us at the Empire Co.'s stand had run from 120,000 miles downwards, and were *bona fide* samples in every way, and we can vouch for it that they gave no sign of being other than brand new. It would have been difficult with any gauge so rough as a pair of good callipers to pick out old rollers from new.

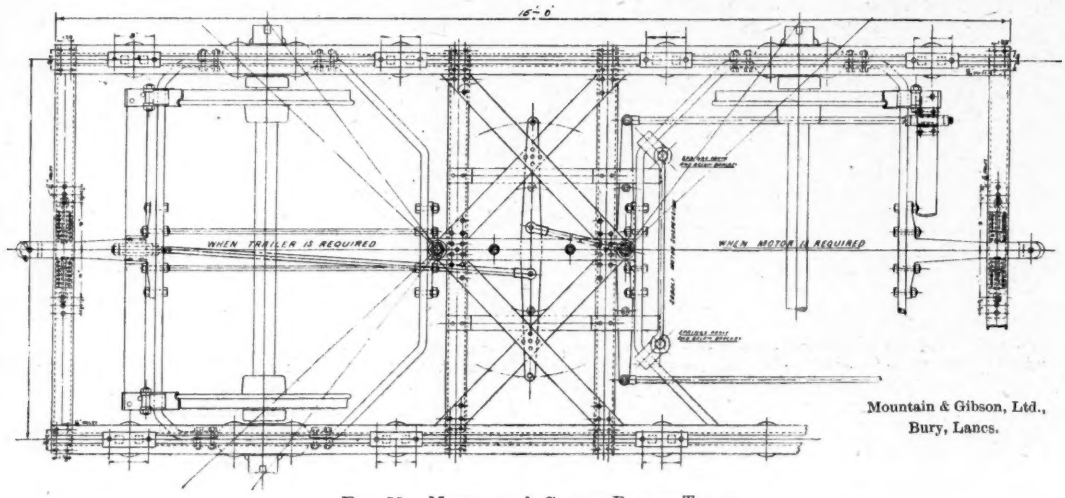


Fig. 35.—Mountain & Gibson Radial Truck.

the old style will result in an order, after all, for comparative tests of this kind have to be taken over a considerable period of time if they are to be of any value, and as often as not the actual running cost of the existing bearings is unknown.

Although the roller-bearing people may have worked a manager up to enthusiasm at the outset of the test, several months of waiting will act as a damper, and by the time the results are presented in all their glory our cold-douched manager has had too much time to consider the reliability of tests in general and roller-bearing tests in particular.

The disheartening failure of many patent forms of "frictionless" bearings after the first six months or so of running out of leading strings has made most of us despair of final success, although no one has failed to appreciate that an economy worth having will be available directly a roller-bearing can be proved by lengthy experience under ordinary work-a-day conditions to be at least no more costly in up-keep throughout the life of the truck than the solid bearing, while the saving in energy consumed in driving the car will leave a handsome balance after allowing for interest on the difference between the first costs of the two kinds of bearing.

The Empire Roller Bearing Co. have dispensed with the compli-

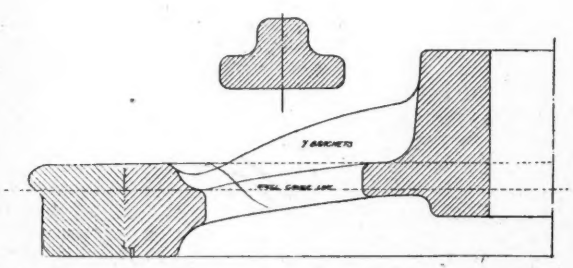


Fig. 36.—Section of British Griffin Steel-tired Wheel.

cations which used to be thought essential for overcoming end thrust, for they contend that with a properly-constructed roller bearing there is no end thrust worth mentioning. That at once simplifies the complicated and makes us more hopeful, and hope is engendered still further when we see that by enclosing the roller-cage in a steel liner which is free to swivel within defined limits inside the journal box proper, the old serious difficulty of uneven wear on the rollers and grinding away of the cage owing to the want of absolute alignment between the axle and the rollers is cancelled. This arrangement permits the rollers to become self-aligning. Last November every paper described a Press run on a L. B. & S. C. train equipped with these bearings throughout, which, we gather from the *Engineer* of November 18th, showed no signs of wear after 80,000 miles, while it was claimed that the fuel consumption was reduced by 10 lb. per mile. Careful tests to establish the true economy are being made by the Railway Co., and we shall hear more about the matter in due course.

Meanwhile the adoption of the bearings on the Southport Tramway Co.'s cars is said to be a leading cause of the phenomenally low rate of energy consumption for which the line is famous, and

It is claimed for these bearings that they will effect economies as follows:—

In coal on railways	10 per cent.
In energy on tramways	25 to 30 per cent.
In power on shafting	50 per cent.
In lubrication everywhere	50 to 75 per cent.

Now, tramway managers, is it not worth while risking a few pounds to make sure whether you can get that 25 to 30 per cent. in energy?

Wheels.—Our readers cannot fail to have observed our open attitude on the ticklish subject of car wheels. While giving good reasons for our belief that at the prices which ruled up to 12

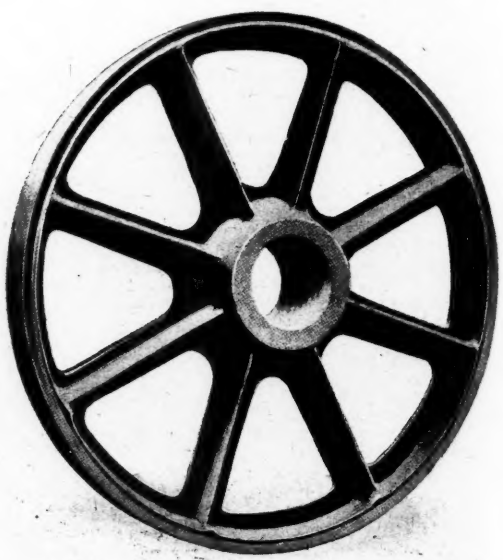


Fig. 37.—Baker Forged Steel Wheel Centre.

months ago and on the statistics of life available from many sources, the cast-iron wheel was a more profitable investment—speculation if you will—than the steel-tired wheel, we have maintained that it is the prime cost only which has stood between the latter and victory. On the word of certain improvements in the method of manufacture which were said to have reduced the cost of steel-tired wheels by 50 per cent., we felt that the victory was assured if the report could be substantiated. All the world knows now that the improvement consisted in replacing the wrought-iron or steel centre by a cast-iron centre, an idea for which credit is due probably to the British Griffin Co., who have been astute enough to turn the steel tire tide in their favour, perhaps after finding

that merely holding up a warning finger could not stem it. We hear that the experimental wheels which were made by the Liverpool Corporation Tramways after this idea have not been uniformly successful, but the British Griffin Co. have had too much experience in designing wheels to allow any but the rarest exceptions to break, and the steel-tired wheels with cast-iron centres, which they showed at Islington, were models of what a wheel should be. Fig. 36 gives a drawing of a section through half a wheel.

The British Griffin Co. point out that the maximum working strain for cast-iron in compression (constant load) is 6 tons per sq. in., whereas it is but 4 tons per sq. in. for wrought-iron. Unfortunately, it does not appear that the consumer is to save 50 per cent. in first cost, for we learn that the price of a 31-in. to 32-in. steel-tire wheel with cast-iron centre is in the neighbourhood of £3, while with wrought centres it is about £3 10s., which is no more than 17 per cent. higher.

This stand was most interesting for its relics. There was a 40,000 miles wheel from Wolverhampton and a 30,000 wheel from Norwich, which ought to have done much to dispel the *canard* that the average life of a cast-iron wheel is 23,000 or thereabouts.

To show that the usefulness of a chilled-iron wheel extends beyond tramcars, for which the company still believe them to be the best, several heavy railway wheels for use under 40 to 50-ton wagons abroad were exhibited.

Messrs. Miller & Co., Edinburgh, the oldest cast-iron wheel makers in Britain, had a stand which differed little from their rivals'. Everything in the way of wheels, from horse-car wheels to heavy railway wagon wheels, found a place, and there was also a 150-ton hydraulic press, of which over 170 have been made. Messrs. Miller say that they "have made steel-tired wheels with cast-iron centres where such have been demanded, although they concern themselves principally with the manufacture of chilled car-wheels, which have hitherto been found most economical for car service, although, in some cases, the steel-tired wheel is preferred."

Messrs. Hurst, Nelson have a special plant at Motherwell for the manufacture of hydraulic pressed wrought-iron wheel centres, and these were shown in the different stages of manufacture.

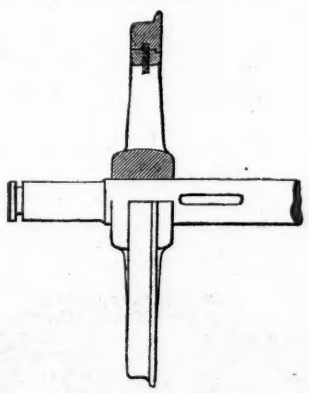


Fig. 38.—Baker Steel-Tired Wheel.

Messrs. John Baker & Co., Rotherham, who are so well known to railways and tramways in want of steel-tired wheels, had a comprehensive display, and there, too, the museum part drew much attention. Everyone desires to know more keenly what something has done than what it will do, and the pile of old tires which had run distances from 68,000 to 57,650 miles in Hull, Leeds, Cardiff and other places must have been a source of some anxiety to the cast-iron rivals.

Fig. 37 illustrates the latest example of the wheel-maker's art. It is a wheel-centre forged without joint or weld out of one ingot of steel—a sufficiently remarkable article. Fig. 38 is a half-section and half elevation of one of the many registered designs of this form and shows the method of securing the tire, which is the same as in locomotive practice, namely, contraction and set screws. Other exhibits included axles and all kinds of steel-tired wheels for English and foreign railways. Messrs. Edgar Allen & Co. had some samples of their steel-tired wheels and toughened cast-steel wheel centres. Now, therefore, the buyer of steel-tired wheels may choose for his centres wrought-iron, wrought-steel, cast-steel or cast-iron.

Among the other interesting things on Messrs. Hadfield's Steel Foundry Co.'s stand there was a good display of car-wheels, axles and tires. In order to prove that Hadfield's wheels are the best a set of wheels which had run 79,680 miles over the Sheffield track was requisitioned. We were told that these wheels had never suffered turning or grinding, and were removed, not because they were worn out, but because the clearance between the motors and the paving had fallen to zero. There was, perhaps, another 5,000 miles still in the old tires.

Hadfield's wheels are made with toughened cast-steel centres and tires of a specially hard and tough grade of steel, which long experience has shown to be the most suitable for tramcar service.

The tires after being shrunk on the centres are also secured by what is known as Hadfield's patent lock fast method, which is said to be more reliable than the usual set screw method, besides allowing the tire to be worn down below what would be the safe limit when set screws are used. As no holes have to be drilled and tapped for the set screws, tires can be renewed more cheaply.

Gears.—How could there be anything of interest in such a dull standardised "line" as gears and pinions? Shall we not be saying all that can be said about them if we quote what the exhibitors themselves say in the catalogue? Whether we turn to the Electric Tramway Equipment Co., R. W. Blackwell & Co., Milnes, Voss, or Player & Mitchell, we see exactly the same thing put in nearly identical words:—"Gear wheels and pinions of all standard types are exhibited, each pinion being cut from an individual hammered forging and the gear wheels from Siemens-Martin open hearth steel" (E.T.E. Co.)

But wait a moment. What do Messrs. John Baker & Co., of Rotherham, say? Something much more interesting:—"Solid forged steel gear wheels. It will be noticed that these gear wheels are in one piece, and not split as is the usual practice. The wheels have been introduced to avoid cutting keyways in the axles, as it is found that tramway axles invariably break through the keyway. These gear wheels are made from one piece of steel, and are forged and rolled up to the required shape. They are then machined up and the gears cut as usual. They are entirely free from blow-holes, soft places, and contraction cracks, and can be made to any reasonable degree of hardness."

That points clearly in the direction along which future practice will travel, and the indication on the finger-post would have been clearer still if the firm which makes cast-steel solid gears, *and does not machine or grind the teeth*, had been represented at the Exhibition.

(*To be continued.*)

PARLIAMENTARY.

The Administrative County of London and District Electric Power Bill.

Wednesday, July 26th.

Mr. C. Pelham, Secretary to the Board of Trade, attended at the request of the Committee, and without going into the witness chair made a statement as to the Board of Trade opinion in regard to the purchase clause. He said that the Board of Trade had seen the promoters, and had suggested certain amendments to the clause which made it workable. At the same time the Board was not prepared to express any opinion as to the policy of the clause. The Board had not heard the evidence for or against the clause, and consequently had nothing to guide them. The only guide which the Board had in the matter was the recommendation of the Joint Committee of both Houses that bulk undertakings should not be purchasable by local authorities. That recommendation had been given effect to as regards power schemes generally.

The Chairman: Have you anything to say as to the 50 years?—The Board did not express any opinion as to the reasonableness of that particular term as compared with the 42 years given by the Act of 1888. As to the price, the terms proposed by the promoters were certainly far more favourable than the terms of the Act of 1888.

Favourable to whom?—To the sellers, the company selling. He did not know of any precedent for the price being fixed by the future expenditure. In the case of the purchase of the Bridges, by the old Metropolitan Board of Works, the price was fixed by the capital invested, and that principle had been adopted in the Bill promoted by the Government for the Port of London. But the Board of Trade were not prepared to express an opinion as to whether that was the right method of fixing the price. There was only one other remark which he would like to make. It should be made quite clear that the depreciation fund at the time of purchase should go over to the purchasing authority.

Replying to various members of the Committee, Mr. Pelham added that the Board of Trade might think it reasonable that the company should be given a longer time than that fixed by the Act of 1888. It was reasonable that they should have a longer term than that given to an ordinary company. As to the desirability of having the clause at all, Mr. Pelham said that he would rather not express an opinion at present.

The Hon. J. D. Fitzgerald, K.C., handed in the alteration suggested by the Board of Trade, which, he said, made no real difference to the effect of the clause. The promoters had agreed to them.

Mr. Falconer was then further cross-examined, and the promoters' case was concluded by the calling of Mr. Gaspard Farrar, of Messrs. Baring Bros., who stated that his firm would be willing to finance the scheme.

Mr. Freeman, K.C., said that he proposed to open the case for the opposition of the borough councils by calling evidence. The chairman agreed to this.

Mr. Charles H. Wordingham, M.I.C.E., &c., was the first witness. He said that he had visited the works of the various local authorities, and knew what had been done. He represented more particularly Camberwell, Deptford, Poplar and Woolwich. In his opinion, the claims of the promoters were based upon faulty assumptions. Dividing these assumptions into six, witness said that the first was that there would be an enormous demand for electrical energy at ¾d. per unit. Secondly, it had been assumed that there was an essential difference between electrical energy for lighting purposes and electrical energy for power. The third assumption

was that the price charged to the consumer corresponded with the average load factor, and the fourth was that there would be a very high load factor. Then the promoters appeared to think that none of the existing companies could produce energy so cheaply as the promoters could, and, lastly, it was supposed that the cost of distribution would be very small. Witness dealt with these in order. He did not agree with the first. He thought that in many cases where steam was in use it would be retained, because in many cases it was also used for heating purposes in certain processes of manufacture. In fact, power might very often be considered as a by-product of heating. Again, gas engines would, he thought, always be used, and they were a formidable competitor, so was hydraulic power. There was certainly no reason to suppose that London manufacturers would rush for a supply of electrical energy. As to the assumed difference between the two kinds of energy, witness denied that there was any real difference at all. Assuming that the power load was good, the factor would be about the same. He handed in a table showing his corrections of Mr. Merz's figures with regard to the price to be charged to the consumer. In regard to the next point at issue, he could not see how a station could get a load factor of 34 per cent. At Manchester there was a good diversity, yet there the load factor was only 19·2 per cent. On the first assumption, witness pointed out that, as yet, electricity could not be commercially stored, as gas or water could. On the question of the cost of distribution, he said that another witness would be called as to that, and would produce figures which he had worked out.

Mr. Lloyd, K.C., then proceeded to cross-examine Witness for the promoters. He admitted that Camberwell had not yet commenced a supply. Woolwich had bought a station at a fairly high price. He believed that the capital cost of the Poplar station was £33 per kw.

Thursday, July 27th.

Mr. J. Horace Bowden gave evidence on behalf of the Borough Council of Poplar. Replying to Mr. Munroe, witness said he was the engineer and manager for the Poplar municipal electricity undertaking. The horse-power in the district at present was 14,000, of which 2,618 was electricity and the remainder steam and gas. He had visited the whole of the persons in his district who signed the petition in favour of the Bill, and he found they represented 5,000 odd h.p., although the petitioners represented that these persons were supplying 17,000 h.p. There were a number of reasons why the local authority did not supply more. A number of persons used steam for other than power purposes, and others installed their own electricity supply. He was told by private persons where they produced their own electricity by gas engines, that the cost of such production was from ·25d. to 35d. Several of the firms told him that they did not support the Bill because they wanted electricity, but simply on the general principle of competition being good. Messrs. Yarrow had 250 h.p. of steam, and their works were driven electrically by power generated by their own plant. He offered to supply the firm at £3 per kilowatt, with a 5 per cent. discount over a certain quantity, and they told him they were not prepared to do anything, because of bad trade. The local authority offered a supply to Messrs. Fraser at 1·10d., and the firm took no notice. Lately they offered to supply the firm at the prices in the Administrative County of London Bill, but this was not accepted. If Messrs. Fraser had accepted the supply at ·92d., it would have been a good thing for the Council. The highest consumers' load factor in Poplar was 29·36, and the lowest, *i.e.*, the Millwall Dock, was 1·98. The average consumers' load factor was 10. The estimates of the company were based on a 42 load factor, which he did not think would ever be obtained. Last year the local authority sold 2,231,000 units of electricity, of which 835,300 were for power purposes. This year the supply for power purposes had gone up. The total capital expenditure incurred up to date was £236,000. Their undertaking was sufficient to supply all the power required if they could get the demand from users.

The Chairman asked if they could not get a list of the capital expenditure of all the local authorities.

Mr. Pollock, K.C., said, roughly speaking, it was something over £5,000,000.

Witness, continuing, said that if their total output were 6 million units a year, the price of ½d. per unit would pay them. If they could sell 12 million units, the price would be even cheaper. They had three extra high pressure turbines, but their experience showed they would want quite as much reserve. While the turbine was a good thing, it was not the phenomenal thing it was said to be. He estimated that, for the year ending March, 1906, their works cost would come out at ·55d.

In cross-examination by Mr. Lloyd, Witness said he believed the rateable value of Poplar was £900,000.

Mr. Lloyd: Is it the fact that the municipal indebtedness of Poplar is higher in proportion to the rateable value than any other municipal borough in London?—I really do not know.

Continuing, Witness said they would not have to spend any money on generating plant for the next two years. It was a fact that last year they published their price for power at 1½d. per unit. He supposed the promotion of that Bill had some effect in bringing down the price.

Mr. Lloyd: When you were supplying at 1½d., what was your works cost per unit?—·77d.

And your total cost, including capital charges per unit?—I am not aware of that.

It was over 2d., was it not?—No, I think not.

Your capital charges alone were over 2d.?—Oh, no; the total costs were 1·23d.

From your own published statement, your works costs was ·98d., and the total cost was 2·2d.—That was in the year 1904.

And the price you got for power was 1½d.?—Yes.

So for power purposes you were selling at that time below the cost price?—No; you can't take into question the management expenses.

Then you allocate the whole of the management charges to the light supply?—No; a certain percentage goes to the power supply, but the management cost does not go up with the supply of power.

But should it not bear its fair proportion?—Yes.

What do you charge for public lighting?—1½d. flat rate.

The total cost for lighting in your borough now costs £12,700 per annum?—I believe about £8,000.

But you take £9,231 for electricity for public lighting, and there is £3,469 for gas. In the year before, when all the borough was lighted by gas, the cost was £5,010. That was in the year 1903?—You have not accounted for the increase in the lighting.

What percentage of your total revenue of the electricity undertaking is for public lighting?—22 or 23 per cent.

Last year something over 30 per cent.?—I think you are right.

It is, therefore, by the conversion of a great deal of your street lighting from gas to electricity that you have been able to make your electricity undertaking pay?—It has helped.

It more than accounts for the balance?—I do not think so.

Further cross-examined, Witness said the works cost to-day was ·67d. He estimated ·5d. for distribution and capital charges. The rates in Poplar were 14s. in the £. He did not know whether in 12 years they had increased from 5s. in the £ to 12s. in the £. He understood that the company would be unable to supply in the Poplar district, except with the consent of the Board of Trade.

Mr. Lloyd: In your view you can supply as cheaply and effectively as the company?—Yes.

Then why have you any fear of the company?—Because some people for some reason or other prefer to take a supply from a company rather than a municipal undertaking. That seems hard on a municipal undertaking.

Do you claim a monopoly?—Under certain conditions.

Under what conditions?—When there is a supply in the hands of a public authority for the benefit of the whole of the community.

What other reasons have you to fear competition?—There is no necessity.

In re-examination, Witness said the company would not have to get the consent of the local authority to supply railways and dock companies, and there was the chance that they would be able to get into the district by quoting cutting prices. The Poplar undertaking had always been self-supporting, and had never drawn a ½d. from the rates.

By Mr. Rutherford: They had for the first time written off £2,500 for depreciation, but he admitted that was hardly an adequate sum.

Mr. John Bussey, chairman of the Electricity Committee of the Poplar Borough Council, said the electricity undertaking had always been self-supporting, and at the present time there was a surplus balance of £3,392. They had paid £4,052 off the capital cost in four years, and had written off £2,500 for depreciation. If they were left alone, he thought they could carry a larger sum to depreciation. Their cost of working had been coming down all along. They had all along contemplated getting a power supply. Except for power purposes and shop lighting, their customers were small. They had expended £236,318 on the electricity undertaking, of which £84,000 was for machinery, £36,000 for buildings and land, and £108,000 for mains and services. They had a capacity of 3,600 kw., but the maximum load had never been more than 1,200 kw. At the present time power represented 50 per cent. of their total output.

In cross-examination, Witness said that the local authority made an offer on July 6th to supply at lower prices for power. If those prices were accepted, and assuming there would be no increase in the demand, the loss on the undertaking would be comparatively nothing. In the first year of their working, they did not make a loss, but they allowed no depreciation. Last year they wrote off £2,500 for depreciation; but if they had written off depreciation first, there would have been no profit. If there had been no profit, they would have allowed no depreciation. If a supply in bulk were offered to them at a price lower than they could generate it at themselves, they certainly would not accept it.

Col. Crompton was called by Mr. Freeman, and said the important matter to consider in this case was the cost of distribution. That was shown in what was known as the Deptford scheme of Mr. Ferranti. He had been in Newcastle, and had seen the maps put in, and the plans of the Newcastle undertaking. He should say that the scheme was ideal so far as distribution was concerned, whereas London had a very poor demand. The high cost of living and heavy cost of manufacture made it impossible for heavy trades to be carried on in London, but at Newcastle Mr. Merz was able to supply a great range of shipyards and factories by a single main. Mr. Merz had also at Newcastle a very cheap supply of coal, and also the North-Eastern Railway to take a large supply. In London there were not the same conditions, and no railway was ready to take a great supply. He had examined Mr. Merz's estimates, and could see no justification for the small sum put down for distribution. Mr. Merz's figure for distribution was £1,089,000, which worked out at £9 per kw. for 120,000 kw. He found that the cost of the undertakings in London varied from £54 in Stepney to £25 in Poplar. He thought Mr. Merz's figure should be doubled, or probably trebled. He was perfectly certain Mr. Merz had made a mistake, which would represent a difference of between £1,000,000 and £2,000,000. The figures given as to the consumers' load factor were certainly not founded on London experience. Anyone who knew London would see that the load factor in London would be much lower than in such a place as Newcastle. All over

London the hours of labour were lower than in the country. In the case of the Pneumatic Dispatch Bill, which he was concerned in, he was negotiating, at the time the Bill was rejected, for power all over London, and would have got it at about ·65d. The local authorities would have jumped at a supply on these terms. It was an academic question whether the saving which the promoters might make on a large generation would counterbalance the extra heavy cost of distribution entailed owing to the great distance that they would have to carry the current. He did not quarrel with Mr. Merz's figures as to the cost of generation, because, when the works were completed he thought he would be able to generate at a very low cost, although at perhaps not quite so low a cost as was set out. He thought railway companies could generate cheaper for themselves than they could get it from the promoters. Witness put in the following tables showing the comparative cost to a railway company of taking its supply of 35,000,000 units per annum at 45 per cent. load factor (*a*) from Merz's proposed bulk supply, and (*b*) from a modern power plant constructed and worked by the company's own staff and using rail-borne coal.

TABLE A.

Total capital employed		£2,091,000
Generating costs—		
Coal—2½ lb. of Newcastle coal per unit	0·114d.	
Wages	0·0118d.	
Water and stores	0·017d.	
Total generating costs	0·1473d.	
Superintendence, rent, rates and taxes ...	0·08d.	
Interest and depreciation on portion of distribution plant employed	0·01d.	
Total cost per unit generated ...	0·3375d.	
Or per unit sold at high pressure at railway company's switchboard	0·3475d.	
4½ per cent. as profit on Merz's capital ...	0·179d.	
	0·5263d.	£76,200

TABLE B.

Total capital employed, 12,000-kw. plant, consisting of four 3,000-kw. Parsons turbo-generator outfits at £12 10s. per kilowatt	—	£150,000
Generating Costs—		
Coal—2½ lb. of Midland nuts, 39,000 tons at 11s. 6d.	—	22,500
Wages	—	2,250
Water and stores	—	1,000
Repairs	—	3,750
Superintendence	—	3,000
Total generating costs	0·224d.	£32,500
Leaving for depreciation, &c., a sum which is sufficient to write off the whole capital cost in 3½ years, *i.e.*	—	43,700
	0·5263d.	£76,200

If gas plant at a higher capital cost were used the coal bill could be reduced by nearly one-half, reducing the total cost, after allowing for increased wages, stores and repairs, and increasing the annual saving to £48,000.

In cross-examination, WITNESS said he was the chairman of an electric lighting company, and they were offering power at 1d. It was formerly 2d. There was a difference in a lighting and a power scheme in regard to the variation of power, but he did not know that that made little difference in the cost of distribution. He did not know the area over which power mains were laid in Newcastle. He was glad to hear that there were 72 square miles in Newcastle laid with mains.

Monday, July 31st.

At the opening of the sitting of the Committee on Monday, Mr. FITZGERALD, K.C., said he was pleased to inform the Committee that terms had been arranged and clauses agreed with the Corporation of Bromley and the Beckenham U.D.C., which were two of the companies in the non-industrial area. The basis of the arrangement was substantially this—that these local authorities for 12 months had the option of taking a supply of electricity in bulk from the Administrative Co. on terms to be fixed by arbitration, but which shall be more advantageous to them than generating the supply themselves. They had also agreed clauses with the London Electric Supply Corporation and the South Metropolitan and Electric Light and Power Co., Ltd., two of the companies supplying in the industrial area, and there again the substance of the agreement was this—that these two companies were adopting the maximum price of the Administrative County Co., and if the Administrative Co. made a reduction in the bulk price at which they gave the companies a supply, then the two companies were to give the benefit of that reduction to their consumers. The terms on which they were to get a bulk supply were to be fixed by arbitration, failing agreement, the intention being that the terms charged for the supply of electricity shall be such as will make it substantially more advantageous for the supply company to take such a supply rather than to extend its plant and manufacture energy for its additional requirements at its own station. There, again, the interests of the company and the consumers had been well protected. As regarded the remaining company in the industrial area—the South London Electric Supply Co., Ltd.—he believed they had also agreed similar terms with them, but there was a verbal inaccuracy in the clause, and in the absence of the solicitor of the South London Co. it would not be right to hand the clause in until it was finally settled. They had also agreed clauses with the Charing Cross, West End and City Co., who were in the non-industrial area. The terms agreed with them followed substantially the clause already put in for the County of London Electric Supply Co. The company would take a supply from the Administrative Co. on very advantageous terms if they wished. There were five other companies supplying in the non-industrial area, viz., the Chelsea, the St. James' and Pall Mall, the Kensington and Knightsbridge, the Notting Hill and the Westminster Supply Corporation, and they had agreed certain alterations in clauses with them and that disposed of their opposition. He hoped the result of these agreements would very much shorten the labours of the Committee.

Mr. GERALD FITZGERALD said that on behalf of the Bromley Corporation and the Beckenham Urban District Council the opposition was now withdrawn; but that, of course, did not affect the other petitioners who appeared on his petition.

Lord R. CECIL, K.C., said the Charing Cross, West End and City Co. were now supporters of the scheme before the Committee. There were, however, certain alterations in clauses in the Bill which, no doubt, his learned friend would put before the Committee.

Mr. FITZGERALD said they would be handed in.

Mr. CLEEVE said that, on behalf of the South Metropolitan Supply Co. and the South London Co., he had to confirm the statement of Mr. Fitzgerald. He did not withdraw opposition, but only suspended it. If the clauses were inserted the Committee would not hear from him again.

Mr. FREEMAN, K.C., in answer to the Committee, said the maximum prices of Poplar were 8d., as was the case with all the local authorities' orders. When Col. Crompton was in the witness chair on Thursday, he put in a table showing what a railway company could supply itself with energy at as compared with taking a supply from the company. There was a clerical error in the table, and Col. Crompton, also, had not worked out details with regard to one figure, and he now handed in a fresh statement which Col. Crompton desired to be substituted.

Mr. FITZGERALD, K.C., said the Local Government Board auditor had made a report on the Islington Borough Council's electricity accounts, the substance of which had appeared in the Press, but on applying at the office of the Islington Borough Council they had been refused a copy of that report. He thought there ought to be no difficulty in being furnished with a copy of such report.

Mr. SAUNDERS (for the Borough Council of Islington): I understood that you had closed your case?

Mr. FITZGERALD said that since he closed his case, a public document had appeared, viz., the report of the Local Government Board auditor on the electricity accounts of Islington. They had asked that Borough Council to supply them with a copy, and they refused, and he asked the Committee to say that the document should be forthcoming.

Mr. SAUNDERS: The answer is that whatever document my learned friend has referred to, is either a public document, or it is not. If it is a public document, my learned friend can avail himself of it without any assistance from me. If it is not a public document, I cannot render him any assistance.

Mr. FITZGERALD said it was a public document, and was in the possession of the Town Council, and it was only from that body that it could be procured. The promoters sent in the ordinary way to the office of the town clerk for a copy, and were refused a copy. The report had been the subject of a public debate in the Town Council.

Mr. SAUNDERS said if it was a report made by the auditor of the Council, it was the Council's property, and his learned friend had no right to come there and endeavour to draw evidence from the Borough Council for his own case. He could not assist his learned friend to get up his case.

Mr. FITZGERALD: I would ask the Committee to say that the document should be produced before the Committee.

The CHAIRMAN: Is it within our power to order the production of that document?

Mr. FITZGERALD: I think it is within your power. I can't imagine that the Islington Borough Council would refuse if you express the opinion that the document should be produced.

The CHAIRMAN: Then we must ask you, Mr. Saunders, to hand in a copy of that document to the Committee.

Mr. SAUNDERS: If the Committee think the document should be handed in, I will do so. What I object to is that I should furnish a copy to my learned friend to prove his case.

Mr. FREEMAN, K.C., said he represented the Boroughs of Poplar, Woolwich, Camberwell and Deptford. Of these, Poplar and Woolwich had their own generating stations, and were themselves supplying electricity, while Camberwell and Deptford had no works of their own, and their districts were supplied by companies. He was thus representing two distinct classes of boroughs, and what he intended to say in addressing the Committee, would undoubtedly apply to all the boroughs concerned.

The CHAIRMAN: Do you mean that it will not be repeated?

Mr. FREEMAN said of course his learned friends representing other boroughs had the right to address the Committee, and he did not know that he could cover all they wanted to say. One could not help feeling that this scheme did come before London with a considerable amount of "takingness," and there was, no doubt, something which appealed to the imagination in giving one supply of electricity to the whole of London by one vast and gigantic undertaking at prices which were exceedingly attractive; but he would show that these figures would not bear examination in the light of day, and that the passing of this Bill would be a very

grave injustice to the boroughs of London, and would be a departure from what he would almost call a Parliamentary arrangement between Parliament and these boroughs. The Bill originated through and had its life and vitality from the Newcastle Co. That was practically the only company amongst the power companies up to the present time which had launched itself upon a successful career; but it had various advantages. It was exceptionally placed as regarded trade, because it had a chain of yards along the Tyneside to which the electricity was supplied at a minimum cost, while the maximum supply was demanded. It had also a railway taking a large supply, and thus had acquired the enormous advantage of a very heavy day load, which removed the inequalities which an ordinary supply had; and, further, it had an exceedingly talented engineer in Mr. Merz, who had carried it on from its earliest stages to its present success. Mr. Merz came as the originator of the scheme, because it was he who got together the gentlemen whose names had been put before the Committee as supporting the Bill. It was a scheme which was supposed to be justified for London because of the success at Newcastle; but he submitted that it was based upon insufficient data, and that everybody had jumped to the conclusion that what was suited for Newcastle would be equally successful in London. It was almost impossible to conceive two sets of circumstances more diverse than those in Newcastle and London. Newcastle was essentially a great manufacturing centre for trades which required a very large amount of electrical power, and there was the immense advantage of being close together, and consequently the company was able to give them a supply at the minimum cost. The exact reverse was the case in London. London was not a place of great manufacturing interests. Most of the great manufacturing interests had already left London in consequence of the high rates, the difficulties of haulage, and such like reasons. The persons in London who would mainly take a supply of electrical power were small producers, who would take but a small supply of electricity. An important factor in connection with this state of affairs was that the company would be called upon to supply over a very large area, and this would largely increase the cost of distribution, for they would have none of the advantages of Newcastle in the way of cheap coal, cheap transit, and concentration of trades. They knew that there had been one scheme for supplying London from one gigantic central station, and this was the Deptford scheme of Mr. Ferranti, which failed utterly to attain its object. It failed because it tried to supply from one gigantic system instead of supplying circuits of reasonable dimensions from a number of stations.

The Chairman: What was the date of Mr. Ferranti's scheme?

Mr. Freeman: 1889.

Mr. Fitzgerald: It is the scheme of the London Electric Supply Corporation.

Mr. Freeman said he would submit that the two questions for the Committee to consider were (1) whether the scheme which was brought forward by Mr. Merz could with reasonable probability be carried through successfully on the lines that he had indicated, and (2) whether such a scheme would involve such injustice and hardship to existing suppliers that Parliament would greatly hesitate before giving these powers against the wishes of the present suppliers. He could quite understand that there was a considerable amount of support brought forward for the Bill. Various persons were called as typical of others who signed the petition, and it would be an astonishing thing if they could not get any number of persons to sign such a petition. They committed themselves to nothing. They were told that they would get electricity at ¾d. or even ½d., as against the 1d. or 1½d. charged now; they were told that they would have the mains brought to their doors, and a supply given without expense, and it would be incredible if, under these circumstances, such people would be hostile to the Bill. It all, however, depended on the statements made by the promoters being capable of being carried out, and he contended that the statements were wholly illusory. Dealing with his second point first, he contended that Parliament contemplated the local authority being the body to supply electricity.

The Chairman: Do you assert that the local authority once being the authorised undertakers no competition has been allowed. Is there no instance?

Mr. Freeman said there were two instances so far as he knew. One was the case of Bermondsey, where the local authority was supplying by far the larger part of the area. One company was supplying a small area in competition with the local authority, and a company was supplying a fragment without any competition from the local authority. Numerous applications had been made by companies and had been refused.

Mr. Fitzgerald: I think you are under a misapprehension in saying that numerous applications have been made to compete in the London area.

Mr. Freeman said he did not for a moment say that under the general Acts, whether it was a local authority or a company, that they were given the monopoly, but he did contend that the Act only allowed competition on the same footing. In this case, however, they were proposing to bring in something quite different. They were bringing in a company which the local authorities would have no power to purchase, and further, if it were an industrial area they could compete direct. This was absolutely unique, and in all the Power Bills which had come before Parliament, there had never been authority given to go into an area which was already supplied in every district. In this way the Bill was distinct from all other Power Bills. He was bound to admit that there had been cases where towns had been taken in the grasp of such power companies, but they were the exception and not the rule. What was the position of the London local authorities? They had spent 5½ millions of money on their electrical undertakings. Many had a considerable amount of room in their buildings in which they could lay down additional machinery. In other cases the local authorities had land on which they could erect additional buildings. In numerous cases the local authorities had committed themselves to contracts. Mr. Merz told them that his company could supply at a price that would make it worth their while to scrap their machinery, but the local authorities viewed with alarm being put into a position of being thrown into the arms of this one supplier. They thought in the public interest this would be an enormous risk, and unless an overwhelming case could be made out to Parliament they should not have those privileges taken away which Parliament had given them. Then they were told that the local authorities should supply to the extent of their present plant and then take a supply in bulk from the company, but if they were able to supply to the present extent, why should they not be allowed to go on developing their supply, and decreasing their charges to the consumers as they went on? With regard to the question of municipal trading, that did not come into the argument, because Parliament had already decided that local authorities should supply electricity for all purposes. They did not ask to even extend their powers, but simply to be allowed to supply in the cheapest and most efficient way they possibly could. There could be no question that the cheapness of electricity depended largely on diversity of load factor, and if the local authorities were not to be allowed to get into their hands the supply of power to manufacturers, then it would mean stereotyping a high charge for lighting.

The Chairman: You don't assert that they compete with you for lighting.

Mr. Freeman said the company would compete in two ways. They took power to supply in bulk, and the person taking a bulk supply would be enabled to use a considerable quantity for lighting his premises. Mr. Wordingham showed that the percentage allowed would be quite sufficient for lighting any ordinary factory. But they competed in another way, and by supplying power, and so preventing the local authority supplying it, they prevented the local authority reducing the price for lighting because they would take away a substantial proportion of the modifying load on which the local authority relied to be able to give a cheap supply of electric light. But the promoters could not supply immediately. At the very least two years must elapse, and it would be probably four or five years before they could give any substantial supply, and this was shown by the fact that they took power to pay interest out of capital during four years. Year by year the local authorities were reducing their prices. In many cases they were now 1d., and was it not a reasonable thing to suppose that by the end of four years the local authorities would be in a position to supply at the same price as the company, if not a great deal cheaper? Therefore, he submitted it would be a very great hardship to them, just when they had brought their works to this state of efficiency to be able to supply at this cheap rate, that those persons to whom they could supply should be taken away from them. Now, Mr. Merz relied on railways, power and traction for the success of his scheme, but what was the position? As regarded railways, at present he had not got a single railway which would take the current, and if the table put in by Col. Crompton were approximately right, then it would never pay railway companies to take power from this company. What did they now find? They found a number of railway companies combining together to build an enormous power station at Lot's Road to supply themselves, and the promoters could hardly expect that those companies would scrap that station and take their supply from them. As to tramways, within a few years they would all be in the hands of the London County Council, who were putting up a generating station at an enormous cost. Unless they got railways and tramways, the promoters could not get the load factor they suggested. Manchester had tramways, but they did not get anything like the load factor that the promoters said they would. Then the promoters asked the Committee to look at their financial strength. He did not dispute it, but it was one of the menaces with which he was faced. It would pay them to get into a district by giving low rates, and after they had beaten out the competition, they would go to the Board of Trade and say they had made a mistake, and persuade the Board of Trade to allow the prices to be raised. Certain assumptions had been made by the promoters on which their whole case rested, and these were not borne out by facts. It was said there was an enormous demand for electricity in London if it could be supplied at anything like ¾d., but he submitted that the evidence showed the promoters had greatly exaggerated the number of persons who would require power. They went on the assumption apparently that the local authorities had been asleep, and had not that push and dash which gentlemen from Newcastle could bring to bear, but the local authorities had done everything they possibly could to get a bigger demand for electricity, and there was no reason to suppose that the company would have any advantages over them so great as to make people suddenly jump up and say they would take it. Then he submitted that the load factor of individual power consumers was nothing like as high as 42. They had carefully gone through the power consumers, and they found, taking good and bad together, there was not a single case where a person got beyond a load factor of 20, and in the case of docks it went down to 1. If that were so, what was going to be the sudden change in the business of London to induce people to jump up from a load factor of 20 to one of 42? If that were not so, then one of the foundations of their structure ceased to exist. The next erroneous assumption was that the load factor of their generating station would be about 34. That admittedly was impossible, unless they got very large assistance from the railway companies. If they did not, they compared with Manchester, and Manchester had got 19. Then they said that no existing generating station could generate at anything like the cost at their station, but in several instances now it was below 1d.

He did not contend that, broadly speaking, Mr. Merz was not correct in his estimate of generating cost, but with regard to the cost of distribution, both Mr. Wordingham and Col. Crompton were agreed that he was absolutely wrong. He had not allowed for anything like sufficient length, or sufficient cost, or sufficient shortness of life. Unless something miraculous happened, it was impossible that electricity could be supplied through these mains at so low a price as was estimated, and that shattered practically the whole superstructure. Then, with regard to the local authorities who had no works, Parliament had given them the right of purchase, and they looked on this right as a valuable asset. If the company were allowed to come in with entirely new powers, the result would be that the business left to the local authority would not be worth purchasing. Proceeding, Mr. Freeman called attention to the Stepney agreement, and particularly to the following clauses:—"(11) The charge to be made by the company in respect of the bulk supply shall not at any time exceed the fixed sum of £3 per annum per kilowatt of the maximum demand and a running charge of ·33d. per unit, and the Council shall have the right at the expiration of every period of five years from the passing of the Act to appeal to an arbitrator, to be appointed by the Board of Trade, for a reduction of the running charge, such arbitrator to have regard to the company's actual cost per maximum kilowatt demanded; (12) the price charged by the Council to the power consumer shall not exceed by more than £1 10s. per annum per kilowatt demanded the price charged by the company for the bulk supply." That clause, he said, meant one of two things. It might mean that under no circumstances were the Stepney Borough Council to charge more than £4 10s. per kilowatt for what they paid £3 for, and that they must charge only ·33d. which they had already paid for the supply in bulk, in which case their only margin was £1 10s., or it might mean that while they must not increase the kilowatt charge beyond 30s., they were free to charge what they liked as regarded the ·33d. If witnesses were called there was reason to believe that the ·33d. was an absolutely unfixed figure, and they could charge anything they liked. He believed, however, that was not the view the company had in entering into the agreement with Stepney. Again, if the Stepney people were restricted both as regarded the charge per kilowatt and the charge per unit, there was no possible scope for them to make a profit and pay the expenses of distribution. In the case of the companies that the promoters had agreed with they had been more generous, and everything was to be settled by arbitration. It all went to show that there was no fixity as to price in the Bill. As to the purchase clause, it was utterly illusory. It was not of the slightest benefit as it stood to the persons for whose benefit it was supposed to be, and did not do the slightest harm to the promoters. It did not fix anybody as the purchasing body, and it was drawn so as to be of no practical utility. It was a clause put forward simply to get the second reading, and should be carefully scrutinised, as part of the preamble objections he was now urging. He asked the Committee to say that the Bill was incapable of proof, because it could not do what it was purported to do, and because there were persons already doing what was required with ratepayers' money.

Mr. McKinnon Wood, Chairman of the Parliamentary Committee of the London County Council, was called by Mr. L. Coward, K.C. He said he would not deal with the details of the Bill but confine himself to questions of broad principle. It was the opinion of the County Council that the whole question of the electricity supply of London was analogous to that of the traffic question upon which a Royal Commission had sat at the suggestion of the County Council, and he submitted that some such proceedings should be followed in this case. All the objects of the Bill were secured by the Government Electricity Supply Bill. The Bill before the Committee meant monopoly, and the result would be much the same as in the case of the water and telephone companies. Amalgamation seemed to be the natural process in such cases, and unless this company followed the process it would not be a success. If they did follow that process it would be a monopoly.

(To be continued.)

Electric Lighting Provisional Orders (No. 5) Confirmation Bill.

This Bill came before Lord Kintore's Committee of the House of Lords on 28th ult. The only order which was opposed was that of the Surbiton Urban District Council, the opposition coming from the Kingston Gas Co.

Mr. Wedderburn, K.C., who appeared for the promoters, said that the Urban District Council, or, rather, the body which was now that Council, obtained an order to supply electricity in 1891. In the year 1894, and again in 1895, the Council's administrative area was extended, the result being that now the administrative area was larger than their electric supply area. The object of the present order was to make the two areas co-extensive. Dealing with the history of the case as it was affected by the opposition of the Gas Co., learned counsel said that the District Council did not act under their order until 1902. In that year they entered into an agreement with Callender's Cable and Construction Co., under which the promoters contracted to provide a site and a generating station. The company were to take a lease of the generating station for 25 years, and to supply electricity. The company were to make whatever profit they could, and to pay to the Council a rent sufficient to enable the Council to pay the sinking fund and interest charges. The Committee would see, therefore, that though the Council could not make a profit, they could not make a loss, for no charge could fall upon the rates. The agreement could be terminated at the end of 5, 7½ or 10 years, but there was no intention to terminate the agreement so far as could be seen, although, of course, the Council might some day wish to take over the undertaking themselves. The object of the gas company was to obtain the insertion of the Bermondsey Clause, but he (Mr. Wedderburn) contended that it could hardly be inserted in that Bill, because it could only operate against a local authority. The question was, should the clause be put into operation at such a time as the Council should decide to determine their arrangement with Callenders? To do so, he thought, would be to legislate too far ahead, and might have the effect of causing the Council not to take over the undertaking.

Mr. F. J Bell, deputy and acting clerk to the Council, gave formal evidence bearing out counsel's opening statement.

The Committee, having heard Mr. C. C. Hutchinson on behalf of the Gas Co., decided not to grant them the clause.

Private Bills Proceed.—It is satisfactory to record that the opponents of order and progress in the House of Commons have withdrawn—in the interests of workmen whose future employment they were placing in jeopardy—their objections to many useful private measures, and, in consequence, on July 27th that House considered, and agreed to, the Lords' Amendments in the case of the following Bills:—Bootle Corporation Bill, Great Northern, Piccadilly and Brompton Railway (No. 1) Bill, Shropshire, Worcestershire and Staffordshire Electric Power Bill, Baker Street and Waterloo Railway Bill, Charing Cross, Euston and Hampstead Railway Bill, Edgware and Hampstead Railway Bill, Metropolitan Electric Tramways Bill, and the Dublin United Tramways Bill.

The following Bills were read the third time:—Metropolitan Electric Supply Co. (Acton District) Bill, and South Lancashire Tramways Bill. County of London Electric Supply Co. Bill, North Metropolitan Electric Power Supply Bill, Shepton Mallet Gas Co. (Electric Lighting) Bill.

ECONOMY IN BOILER PLANT.

Although builders of boilers are presumably the persons most interested in building an efficient steam-raising plant, it must be remembered that they are hampered by conditions of competition arising from an improper understanding of the process of combustion and heat transmission on the part of prospective purchasers. The paper read before the Institution of Electrical Engineers by Messrs. Booth and Kershaw pointed out that, for the proper combustion of bituminous coal, a large combustion chamber and the use of refractory surfaces is necessary. This, however, means increased cost of boiler setting, and the temptation is very strong to tender for and build a boiler which will generate its guaranteed steam per pound of coal, when, say, anthracite is used, independently of the consideration as to whether Welsh coal can be economically brought to the locality of the boiler. In asking for tenders for boilers, therefore, the class of fuel to be used should be specified and a water evaporation guarantee on this basis asked for.

Where such precautions are previously omitted, losses in the steam-raising plant are certain to ensue. Air will probably be admitted in excess above the grate to avoid smoke nuisance, bringing down the temperature of the furnace gases. Increasing the amount of air admitted increases the energy consumed in producing draught and the amount of heat carried off to the stack. An artifice to prevent the premature cooling of the gases by contact with water-cooled plates and tubes is the introduction into the furnace of refractory brick baffles. Where the combustion chamber is not sufficiently large to contain these refractory surfaces, they are often interspersed among the tubes and flues. As, however, the gases have already become partially cooled, such devices can only be regarded as makeshifts to cover an initially bad design, and have, moreover, the effect of reducing the effective draught. Where it is found absolutely necessary for the avoidance of smoke nuisance to admit air above the grate, such air should be previously heated as much as possible to reduce the cooling of the combustion chamber as far as practicable.

In some boilers steam is admitted below the fire-grate. This device is useful where fuel giving intense local heat, such as anthracite or coke, is used, as the rapid deterioration of the furnace bars is avoided by the cooling action of the steam, and this steam, in passing through the bed of incandescent fuel, unites with the carbon to produce water-gas. It is, however, a fallacy to suppose that the admission of steam above the grate aids combustion. The space above the fires should be exclusively reserved for the proper intermixing and ignition of air, oxygen, carbon or carbon-monoxide, and the energy absorbed in the dissociation of water will result in a net loss of heat.

To obtain the greatest amount of steam per lb. of coal from the boiler, the maximum difference of temperature between the water and flue gases must be obtained at every point along the passage of the gases through the boiler. For this reason the hottest water should be found at the point where the gases first impinge on the heating surfaces, and the point of inlet of the feed water should be as near as possible to the point of exit of the gases to the main flue. Due recognition of the elementary principle that cold water is of higher specific gravity than hot will tend to better design from the point of view of circulation, and consequently better evaporating qualities.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

11,970A. "Improvements in electric couplings." The British Thomson-Houston Co., Ltd., and E. B. Wedmore. (Date applied for under Patents Rule 9, June 7th, 1905.) July 18th.

11,971A. "Improvements in and relating to electric current rectifying systems." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) (Date applied for under Patents Rule 9, June 7th, 1905.) July 20th.

14,660. "Improvements in or relating to vapour electric lamps." F. Harrison. July 17th.

14,663. "Improvements for central battery telephone transmitters." J. H. Scales. July 17th.

14,713. "Improvements in electric arc lamps." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) July 18th.

14,714. "Improvements in and relating to electric measuring instruments." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) July 18th.

14,715. "Improvements in vapour electric rectifiers." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) July 18th.

14,736. "New electric switch for recording, indicating and controlling main switches by magnetic coils." C. I. Adams and W. Brand. July 18th.

14,749. "Improvements in electric stop motions for looms." P. Vindrier. July 18th.

14,751. "Improvements in electric dynamos and motors." C. Macku. July 18th.

14,770. "Improvements in and relating to telegraphic instruments and the like." A. Gentili. (Date applied for under Patents Act, 1901, July 19th, 1904, being date of application in Italy.) July 18th. (Complete.)

14,780. "Improvements in or relating to apparatus for electric welding." H. H. Lake. (The Clinton Wire Cloth Co., United States.) July 18th. (Complete.)

14,785. "Improvements in connection with frogs and switches and crossings for the overhead conductors of electric tramways and railways." I. E. Winslow. July 18th.

14,788. "Improvements in or relating to wireless telegraphy." G. Marconi and Marconi's Wireless Telegraph Co., Ltd. July 18th.

14,808. "Improvements in telephone shells." W. R. Sine and J. S. Rosenthal. July 18th. (Complete.)

14,837. "Improvements in or connected with trolleys of overhead electric railway vehicles or locomotives." R. W. Dunn. July 19th.

14,879. "Improvements in and relating to safety devices for electric motors and the like." The Johnson-Lundell Electric Traction Co., Ltd., and J. H. Robertson. July 19th.

14,889. "Improvements in submarine electric cables." P. Coridori. July 19th. (Complete.)

14,898. "Improvements in the manufacture of filaments for incandescing electric lamps." J. R. Crawford. July 19th.

14,905. "Disinfector appliance for telephone transmitters." E. C. Phillips and F. E. Shedd. July 20th.

14,955. "Improvements in the production of long stable electric arcs." J. Y. Johnson. (The Badische Anilin and Soda Fabrik, Germany.) July 20th.

14,959. "Improved sparking coil with multiple winding for ignition and like purposes." Societe d'Electricite "Nilmelior" and A. Michel. July 20th. (Complete.)

14,964. "Improvements in electric hoists and conveyors." J. G. Childs. July 20th.

14,971. "Improvements in and relating to electric switches." N. Hamilton. July 20th.

14,972. "An improved process of obtaining a substance particularly adaptable for making incandescent electric lamp filaments thereof." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) July 20th.

14,973. "Improvements in mercury vapour electric apparatus." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) July 20th.

14,978. "Improvement in electric switch." G. L. Herz. (Date applied for under Patents Act, 1901, October 7th, 1904, being date of application in United States.) July 20th. (Complete.)

15,002. "Improvements in and relating to electrically-controlled variable speed gear." H. V. James. July 21st.

15,017. "An improvement applicable to the trolley poles of electric cars." J. S. Finney. July 21st.

15,022. "Receivers suitable for use in wireless telegraphy or telephony." J. G. Balsillie. July 21st.

15,045. "Improvements in electric train control systems." A. Sundh and A. Magnuson. (Date applied for under Patents Act, 1901, February 15th, 1905, being date of application in United States.) July 21st. (Complete.)

15,055. "An improved process for extracting metals from ores and other metalliferous material by electrolytic means and apparatus therefor." Ganz and Co., Eisengiesserei und Maschinen-Fabrik Act.-Ges. (Date applied for under Patents Act, 1901, August 26th, 1904, being date of application in Germany.) July 21st. (Complete.)

15,067. "Improvements in and relating to the regulation of alternating-current dynamo-electric machines." The Allgemeine Elektricitats-Ges. (Date applied for under Patents Act, 1901, July 22nd, 1904, being date of application in Germany.) July 21st. (Complete.)

15,071. "Improvements in protective devices for electric circuits." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) July 21st.

15,074 "Improvements in or relating to means or apparatus for regulating the difference of potential between portions of alternating electric current distributing systems." A. F. Berry. July 21st.

15,084. "Improvements in means for enclosing electric switches and pushes, and other apparatus requiring manipulation in a medium from which they must be protected." C. A. Peck. July 22nd.

15,091. "An improved type of house-service fuse box for the supply or distribution of electricity." T. Henwood and F. C. N. Bergh. July 22nd.

15,101. "Magnetic tubular hammer." H. J. Dale. July 22nd.

15,121. "Improvements in and relating to electric sparking coils." D. E. Brown. July 22nd.

15,125. "Improvements in the electrolytic manufacture of metal-wire strip or the like." S. O. Cowper-Coles. July 22nd.

Asylum Installation.—The Eldon Electric Co., of Newcastle-on-Tyne, have secured on behalf of their principals, the Simplex Steel Conduit Co., Ltd., the order for "Wireduct" conduit and fittings for the Narborough Asylum, Leicestershire, from Messrs. Cox-Walkers, of Darlington.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1904.

Space Telegraph System. J. S. Stone. 29,144. (Date applied for under Patents Act, 1901, April 11th, 1904, being date of application in United States.) December 30th.

Switch Point and Frog for the Overhead Equipment of Electric Traction. J. Bonthrone. 5,634. March 8th.

Telephone Systems. G. E. Parker and M. A. Adam. 6,030. March 11th.

Contact Breakers. J. C. Fuller and G. Fuller. 6,104. March 12th.

Electrically-Energised Pendulum Clock. G. O. Granger. 8,398. April 12th.

Device for Shifting Type Carriers. W. Benicke and H. Westerbeck. 8,575. April 14th.

Igniting Devices for Miners' Safety Lamps. C. A. Day. (Fabrik Elektrischer Zunder G.m.b.H., Germany.) 9,103. April 20th.

Treadles or Contact Makers for Railway Signalling and the like. S. P. Wood and McKenzie & Holland, Ltd. 9,377. April 23rd.

Covers for Tumbler Switches. The General Contracts Co., Ltd. and W. H. Flood. 9,744. April 28th.

Supports for Electric Cables. Callender's Cable and Construction Co., Ltd and J. C. A. Ward. 10,055. May 2nd.

Vapour Electric Apparatus. E. A. Carolan. (General Electric Co.) 10,248 and 10,249. May 4th.

Switches. British Thomson-Houston Co., Ltd. (General Electric Co.) 10,456. May 6th.

Arrangement of Electric Motors on Electrically-Driven Vehicles. F. Krizik. 10,551. May 7th.

Poles or Electrodes of Electrolytic Apparatus and the like. G. J. Atkins. 11,470. May 18th.

Electrolytic Manufacture of Water-Jackets. A. F. Bosquet. 20,627. September 24th.

Arc Light Electrodes. W. S. Weedon. (Date applied for under International Convention, December 10th, 1903.) 26,922. December 9th.

Electrical Distribution. J. H. Hallberg. 27,209. December 13th.

Electric Measuring Instruments. H. H. Lake. (V. Arcioni, Italy.) 29,363. December 31st.

Distribution of Electro Motive Power for Use in Starting Machinery. G. W. Mascord. 727. January 11th.

Vapour Lamps. C. O. Bastian. 5,892. March 10th.

Signalling Instruments. H. W. Sullivan. 6,811. March 21st.

Electrolytical Extraction of Metal from Solution. J. F. Webb. 6,832. March 21st.

High Tension Electric Current Switches. British Thomson-Houston Co., Ltd. (General Electric Co.) 10,242. May 4th.

Driving Gear for Electrically-Driven Rotary Brushes. J. MacLean. 10,525. May 7th.

Trolleys for Electric Tramway Vehicles. T. Blaney. 10,812. May 10th.

Heating by Electricity. A. Voelker. 10,873. May 11th.

Signalling. L. A. Hards. 11,116. May 13th.

Switch Mechanism for Use in Connection with Intercommunication Telephone Instruments. The Electric and Ordnance Accessories Co., Ltd. 13,'07. June 10th.

Protective Systems for Electric Distributive Lines. L. Wilson. 25,220. November 19th.

Secondary Batteries. W. Gardiner. 27,904. December 20th.

Current Distributors for the Electric Ignition Devices of Internal Combustion Engines. L. Renault. 29,408. December 31st.

Switches. G. H. Atkinson. 6,560. March 17th.

Call System for Telephone Stations. V. Ammer. 6,646. March 18th.

Mercury and other Vapour Apparatus for Converting and Obtaining Light from Alternating Electric Currents. O. Holz. (Date applied for under International Convention, March 23rd, 1903.) 7,064. March 23rd.

Transmitting Electric Alternating Current through a Vapour for Rectifying or Lighting Purposes. E. Weintraub. (Date applied for under International Convention, March 23rd, 1903.) 7,065. March 23rd.

Alternating Current Rectifying Apparatus. C. P. Steinmetz. (Date applied for under International Convention, March 23rd, 1903.) 7,066. March 23rd.

Rectifying Alternating Currents. E. Weintraub. (Date applied for under International Convention, March 23rd, 1903.) 7,067. March 23rd.

Arc Lamp Electrodes. R. Fleming. (Date applied for under International Convention, March 26th, 1903.) 7,298. March 26th.

Arc Light Electrodes. J. T. H. Dempster. (Date applied for under International Convention, March 26th, 1903.) 7,'99. March 26th.

Switches for Use in Connection with Electric Lights. G. Chisholm. 7,748. April 2nd.

Insulators for Overhead Electric Conductors. F. Hutchines. 8,517. April 13th.

Electric Telegraphy. S. G. Brown. 10,073. May 2nd.

Vapour-Electric Apparatus. E. A. Carolan. (The General Electric Co. United States.) 10,246. May 4th.

Switches. The British Thomson-Houston Co., Ltd. (General Electric Co., United States.) 10,460. May 6th.

Switches. The British Thomson-Houston Co., Ltd. (General Electric Co., United States.) 11,090. May 13th.

Dynamo-Electric Machines. The British Thomson-Houston Co., Ltd. (General Electric Co., United States.) 11,444. May 18th.

Induction Coils. G. E. Gaiffe. 11,554. May 14th.

Arc Lamps. F. de Z. Bermudez. 16,985. August 3rd.

Telephone Systems. J. Young. 20,329. September 21st.

Transforming Alternating Currents of Constant Voltage and Frequency into Continuous Currents of Variable Voltage. G. Paget. 22,752. October 21st.

Protective Systems for Electric Distribution Lines. L. Wilson. 25,219. November 19th.

Hertzian Wave Projecting and Receiving Apparatus for Locating the Position of Distant Metal Objects. C. Hulsmeyer. 25,608. November 24th.

Arc Lamp Electrodes. W. S. Weedon. 26,921. December 9th.

Switches. A. Benassy. 27,003. December 10th.

Accumulators. W. Gardiner. 27,851. December 20th.

Arc Lamps. C. E. Foster, E. R. Grote, and M. V. Ely. 7,610. March 30th.

Generating and Applying Electricity on Railways and other Vehicles. F. J. Beaumont and W. M. Still. 7,614. March 30th.

Transforming or Converting Electric Currents. J. L. La Cour and T. Rich. 7,807. April 2nd.

Electric Washing and Heating Apparatus. C. Bauer. (G. E. Dutertre and M. F. H. Nodet, France.) 7,814. April 2nd.

Electric Meters. B. Krausse. 7,937. April 6th.

Electric Machine Tools. J. S. Fairfax. 8,316. April 11th.

Mechanically Replaced Annunciator Movements for Telephone Switchboards. H. Oppenheimer. (Actiengesellschaft Mix & Genest, Germany.) 8,737. April 16th.